Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. LIII. NEW YORK, THURSDAY, MAY 20, 1909. No. 21.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

JAMES H. McGRAW, President.
J. M. WAKEMAN, 1st Vice-President. A. E. CLIFFORD, 2d Vice-President.
CURTIS E. WHITTLESEY, Secretary and Treasurer.

239 WEST THIRTY-NINTH STREET, NEW YORK.

TELEPHONE CALL: 4700 BRYANT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....590 Old Colony Building
CLEVELAND OFFICE.....1015 Schofield Building
PHILADELPHIA OFFICE.....Real Estate Trust Building
EUROPEAN OFFICE....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION:

United States, Cuba and Mexico	per year,	$3.00
Dominion of Canada	" "	4.50
Other Foreign Countries within the Postal Union	" "	6.00
25 shillings.	25 marks.	31 francs.

Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies of issues prior to July, 1907, are kept on sale, except in bound volumes. Subscription orders being renewable at the end of the month indicated on the wrapper, the sending of remittances on or before that date will be much appreciated by the publishers.

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Entered as second-class matter at the post office at New York, N. Y.

The circulation of Electrical World for 1908 *was* 898,000. *Of this issue* 15,750 *copies are printed.*

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THE HOOSIC RIVER POWER DEVELOPMENTS.

Elsewhere we give an account of a hydraulic development more than usually interesting. Power plants have come of late years to approximate to certain set types which may be taken mostly for granted, but now and then a situation arises which gives full scope for the resources of the engineer. The Hoosic River plant here described belongs to the second category on account of the fact that the total fall is divided into two sections too far apart to admit of utilization as a unit and requiring somewhat different individual treatment. The upper fall at Johnsonville is about 5000 hp at 35-ft. head; storage possibilities about it are, however, excellent, so that a dam about 500 ft. long and 40 ft. high backs up the water to form a reservoir no less than six miles in length and capable of storing a month's supply of water for the Johnsonville plant. This plant consists of two 2500-hp horizontal turbines each coupled to a 1800-kw, three-phase generator. The Johnsonville plant will, so to speak, bear the brunt of the service; during low-water periods it will be run as the water may be needed in the plant below, so that no water will get down stream until after having done duty through the Johnsonville turbines.

The second plant is at Schaghticoke, where a fall of 146 ft. is available. Here four units are installed, each consisting of a Pelton-Francis vertical-shaft turbine directly coupled to a three-phase generator of corresponding power. Through a large part of the year this lower plant obviously furnishes ample power irrespective of what is going on at Johnsonville, but at times when storage is necessary the whole stream will do its turn in Johnsonville before it gets down to the bigger power house and higher head at Schaghticoke. The arrangement is one which is beautifully economical of water, and the plants being worked systematically together, the total efficiency of the stream will prove exceptionally high from the hydraulic point of view. The Johnsonville plant, in fact, will operate under full-load condition all the time, since each of its generators can be given full load whenever it is used at all, leaving the fluctuations to be handled by the Schaghticoke plant which operates on the Johnsonville tail-water.

The transmission line of this duplex plant, although not at an exceptionally high voltage—only 32,000—is worth a word of comment as one of the few important lines in the East using the new suspension insulator. A glance at the top of the line shows both the good and bad points of the suspension type. The former are fairly obvious, and the most casual inspection will show that the danger of the swaying of the lines when carried in suspension, to which reference is now and then made, is practically a negligible quantity. The short distance over which swaying is possible and the weight of the wires should be sufficient insurance against troubles of this kind. On the other hand, the towers required for a double suspension line are tall and somewhat unwieldly, quite certainly considerably more ex-

pensive than some of the other designs that are in use; and where this type of line is used the necessary height increases the temptation to put all one's eggs in one basket by running both circuits on a single line of towers. Experience has shown that this unpleasantly gives a chance of putting both circuits out of commission together in case anything serious happens. This difficulty is, of course, lessened by the long distances between wires, which, however, still further increases the height of the towers. It will require some little experience with this type of line design to show whether it is on the whole better or worse for such moderate voltages than lines with ordinary insulators placed on less lofty supports. However, somebody has to try out these experiments, and in the present instance the construction appears to be thoroughly good.

Improvements in the Quartz Lamp.

From time to time we have published notes regarding the quartz-mercury arc, which is being somewhat extensively exploited in Germany, and in the Digest this week will be found a description of the latest form of this very interesting lamp. It is used there chiefly for display purposes at present, much as the flaming arcs were at first used in this country. Yet it has properties which under favorable conditions might make it an illuminant which would have to be taken seriously for general out-door lighting. The quartz lamp is merely an intense mercury arc, mercury vapor being driven to high temperature and high light-giving power by concentration in a working tube of hardly more than capillary dimension. The light-giving part of one of the modern quartz lamps is, in fact, about the size of a small lead pencil and delivers from 1200 to 3000 hefner-candles, at the specific consumption of hardly more than ¼ watt per candle. The lamps recently reported take from 2½ amp to 4 amp according to size and voltage. The specific consumption just stated applies to the voltage at the tube terminals, which is about 85 for 100 to 130 volts supply and 160 to 180 for double this voltage. Obviously the efficiency reckoned upon the voltage of supply, including ballast, is not so good, running to about 0.37 watt per hefner. This, however, is an efficiency quite comparable with that of flame arcs. One, therefore, has in this quartz lamp a rather exceptional combination of properties—a union indeed of the high efficiency of the flame-arc lamp with more than the endurance of a tungsten incandescent. The life of the tubes employed in the recent models of quartz lamps is stated to be from 2000 to 3000 hours' running, but at times attaining 5000 or 6000 hours. At the present time we understand that practically all the quartz tubes used for this purpose are the product of a single factory. The technology of quartz glass appears to involve some exceptional difficulties which have hindered greatly the application of material otherwise valuable for lamps and for many other purposes. Molten quartz seems never to be at any temperature obtained really fluid, but always somewhat pasty and liable to serious trouble from the formation of bubbles. The quartz tubes as made for these lamps, in spite of showing evidence of the great difficulty of getting a temperature high enough for working them, are very good looking and it may be that further experience will enable them to be turned out in many places and on a sufficiently large scale to bring the lamp into extensive use. At the present, however, the employment of such lamps in this country would be hazardous on account of the extremely local nature of the supply of the necessary material. The light of the quartz lamp is a great improvement on that of the ordinary mercury arc, but is conspicuously lacking in red. It is amply good enough, however, for out-door lighting, and the time may come when it will have to be taken seriously for the larger uses of electrical illumination. At present, from the American standpoint, it is merely a highly interesting specialty, but it will bear watching.

A New Magnetic Surveying Ship.

In the old sailing-ship days, when clipper ships used to race with each other through the trade-wind zones, when vessels were built of timber and sheathed with copper, the magnetic deviation of the compass due to masses of magnetic material on the ship was zero. The variation of the compass was the declination or angle between the geographical and magnetic meridians. The declination was recorded for most parts of the navigable world, so that the navigator could tell where true north lay by taking the direction of compass north and applying the declination for the place. The idea of determining the compass error from day to day never entered the navigator's mind. Nowadays, with steel hulls in vessels with steel decks, steel masts, steel ropes, steel everything, the deviation error of the compass due to the ship's magnetism may be much larger than the declination. In fact, it is sometimes found impossible to make a compass act serviceably in particular locations on a vessel owing to the marked local magnetic field swamping the earth's magnetic field. Moreover, the ship's magnetic effect varies from week to week, not merely on account of change in the arrangement of equipment or cargo, but also on account of changes in the magnetism of the ship's hull in different magnetic latitudes or on different magnetic courses. Consequently, navigators are compelled to measure their compass variation, including combined deviation and declination, at frequent intervals, usually by taking the sun's bearing, at any determined time, but particularly at rising and setting.

It is evident that a modern steel vessel is unsuited for accurate measures of the magnetic declination at sea, because the deviation due to the steel in the vessel is so large by comparison with the declination. Although a knowledge of magnetic declination over the oceans is not so important to navigators as it used to be, yet it is of great importance to magneticians generally. The Department of Terrestrial Magnetism of the Carnegie Institution of Washington employed a wooden survey yacht, the *Galilee*, on valuable work for nearly three years in the Pacific Ocean, cruising about under sails, and measuring the earth's magnetic field. Recently it has been decided to build a special wooden ship for this work, to be named the *Carnegie*, a brigantine 155 ft. long, of 12½ ft. mean draft, and 570 tons displacement. Since the *Galilee* narrowly escaped loss for want of auxiliary power, a small internal-combustion engine is to be used on the *Carnegie* capable of giving the vessel a speed of 6 knots in calm weather. The auxiliary power plant is to be of non-magnetic material as far as possible, all fastenings are to be of non-magnetic metal, and the rope rigging is to be all of hemp. It will be interesting to learn how nearly non-magnetic a survey vessel can be constructed with an auxiliary power plant, propeller and propeller shaft. The magnetic observatory is placed amidships, on the main deck, comprising a square room and two towers. The vessel is designed for long cruises, and

can work in any part of the navigable world. Her crew may be kept actively at work, but will probably not suffer from over-strenuous life.

A GRAPHICAL STUDY OF SELF-INDUCTION.

Self-induction may be defined as that property of a circuit by virtue of which changes in current strength can only be brought about by electromotive forces. Moreover, the more sudden the changes in current, the more powerful these electromotive forces must be. In fact, at any instant, the inductive e.m.f. is equal to the self-induction in the circuit multiplied by the rate of change of current. This property of a circuit is therefore analogous to inertia in matter; forces are invoked when matter changes its velocity, and the magnitude of these forces depends upon the suddenness in the change of velocity. Hence self-induction is sometimes described as the electromagnetic inertia of a circuit. The rules of the differential calculus naturally apply to the phenomena either of mechanical inertia or of electromagnetic inertia. But it is not necessary to use the calculus in order to understand and to describe these phenomena. Graphic methods, for example, may be used. The article by Mr. F. P. McDermott, Jr., on page 1215, discusses the application of a graphic method to problems connected with the rise of current in a circuit possessing resistance and inductance under the application of a steady e.m.f. The curve of current rise is developed graphically by successive steps. It is shown that the method may be extended to cases of divided circuits, which are distinctly more complex than simple undivided circuits. All such graphic methods have their value, not only for giving quantitative results to those who cannot use the calculus, but also for illustrating and throwing side lights upon the subject to those who can and do avail themselves of the calculus. All methods are good and helpful in their proper spheres of influence. Nevertheless, a careful study of this particular graphic method will, we believe, reveal the fact that anyone who can understand and apply this method would be amply capable of understanding and applying the regular method of the calculus with but little extra effort. In other words, the use of elementary calculus in most engineering problems is not nearly so difficult as is commonly supposed by the uninitiated.

ELECTRICITY AND THE CONSERVATION OF ENERGY.

At a recent joint meeting in New York of the Societies or Institutes of Civil, Mechanical, Electrical and Mining Engineers a paper was read by Mr. Lewis B. Stillwell upon the subject of "Electricity and the Conservation of Energy." This paper is of interest to all engineers, because it points out that the question of conserving natural resources is, aside from its general relations to the public at large, essentially an engineering question, in the technics of which engineers should have a leading voice and an authoritative judgment. Whether a certain line of policy in conservation should be followed in the main, is a political and economical question that lies within the decision of the community at large. But questions as to what particular policy should be adopted in detail, how to carry it into effect, and what to expect therefrom are engineering questions that can only be properly answered after consultation with qualified engineers. The paper points out that there are three ways in which electricity serves to save coal: First, by enabling waterfalls to supply power at a distance; second, by enabling coal power to be used at a distance from large economical engines, and third, by substituting electric locomotives for steam locomotives. It is pointed out that in 1908 the plants of the Niagara Falls Power Company delivered 560,000,000 kw-hours, or 64,000 kw-years. This saved to the nation in that year 1,000,000 tons of coal if burned in the individual plants of the consumers, or nearly 2,000,000 tons if burned in a large number of small plants. But that was not all of the benefit. Much was produced electrochemically by the Niagara water-power, which could not have been produced commercially in any manner by steam-power. Since the total output of coal in the world in that year is placed at about one thousand million tons, Niagara power saved about one quarter of 1 per cent of this total, or about one-half of 1 per cent of the total coal output of the United States.

Concerning water-power available in the United States, there is still much guess-work, but the report of the Inland Waterways Commission estimates it at 37,000,000 hp available at a cost comparable with that of steam installation. The estimate of the industrial use of power in the United States at the present time is 25,000,000 hp in stationary engines and 2,000,000 more in locomotives, or 27,000,000 altogether. Only 5,000,000 hp in this total are at present derived from water-power. With the exception of a scant 1,000,000 hp from gas and oil engines, the rest is all developed from coal. Consequently, according to the estimate of the commission above referred to, the water-power of the United States capable of being developed at a cost comparable with steam installation would supply all the power used at present in the United States and half as much more. It must, however, be remembered that a large part of the said available water-power is remote from present markets and that a considerable fraction of it is at a distance from markets greater than the present commercial radius of electric-power transmission.

The paper also discusses at some length the political or economic policy that many recommend at present of taxing working water-powers to pay for developing water-way transportation. Doubts are expressed as to whether we can afford to pay large sums for canal systems. A reasonable expenditure for canals is admitted to be commercially justifiable; but what many seem to think a proper expenditure on canals is claimed to be unsound finance. This is a large public question, but of great importance to engineers and to engineering; but, whatever its precise answer may be, we entirely agree that, for the present, electric reclamation of water-power should be encouraged as far as possible and not burdened unnecessarily by taxes. Every hydraulic kilowatt utilized industrially saves at least 10 tons of coal per year, not merely for one year, but for all time. There can be little doubt that the only way to utilize the water-power of the country to its full effectiveness with the greatest economy is to use the water of a river many times over in smaller hydro-electric plants, rather than to attempt using it only once or twice in colossal plants. By this means, a large number of small lakes can be made for impounding the water on the tributary streams at relatively small cost for land, dams and power houses; while all the stations will contribute power to a large electric-conducting network. In this way, under collective operation, the natural differences of water level may be availed of most favorably.

The Patent System in Its Relation to Industrial Development.

At the annual meeting of the American Institute of Electrical Engineers, held in New York, May 18, Mr. Frederick P. Fish presented a paper entitled "The Patent System in Its Relation to Industrial Development." The paper opens with an interesting historical account of the patent system from its earliest beginnings in the fifteenth century, and treats in detail the development of the patent system of Great Britain, founded toward the end of the sixteenth century. Taking up the patent system of this country, Mr. Fish says that while many other considerations may have played an important part in our national development, it seems to him certain that this development is largely due to the special character of our patent system, and its efficiency in encouraging invention. Our patent system amounts simply to the grant to one who has had the intelligence and skill to make an improvement in the useful arts which involves invention, of the exclusive right, for a term of 17 years, to make, use and sell that which he has discovered, invented or designed. Our system is much more liberal than those of foreign countries. In some countries a patent grant is forfeited if there is no manufacture under it within a certain limited period; or again, the owner of a patent may be forced to grant licenses to manufacture the invention covered. Mr. Fish does not favor either of these restrictions.

Referring to some of the criticisms of our patent system, Mr. Fish believes that some reform could be brought about by an intelligent and well-directed effort on the part of the patent bar and the courts. He added that many of the evils ascribed characterize the practical operation of all human institutions, and we can only hope to minimize them. He favored the establishment of a single Appellate Court to take the place of the nine independent Courts of Appeal now existing, and a reorganization of the Patent Office that will enable it to do more effective work in its examination of applications.

Referring to the proposition that patent protection exists primarily, not for the benefit of the inventor, but for the benefit of the community, he said that the patent systems of the world agree in giving legal sanction to property in inventions, partly because of a feeling that the inventor has some abstract right in them, but for the most part as a matter of public policy to stimulate and secure the promotion of the useful arts. In regard to the suggestion that our patent system should discriminate against foreigners, Mr. Fish said that he was satisfied that there should be no change made in our present policy of non-discrimination.

In the opinion of Mr. Fish there is no valid foundation for the suggestion that inventors are not adequately compensated. To many of them their inventive capacity is a part of their stock in trade. Because they can invent, they receive substantially more by way of salary and standing than would otherwise be the case, as do those who are deft in the use of tools, or who show skill as designers or capacity as salesmen. In many instances the inventor is the only one who has made any profit out of an enterprise based on patents. And it should not be overlooked that by far the greater part of inventions, particularly at this late stage of the older arts, are mere details of improvement or alternative devices or methods from which, regarded specifically, no large amount of profit can be made by any one. Such inventions are only valuable as incidents to the manufacture, and cannot be segregated and appraised independently. In conclusion, Mr. Fish expressed the belief that in spite of occasional cases of hardship, such as occur in every business and profession, the ordinary social and business principles which, irrespective of the patent law, determine the distribution of the profits of invention as between the inventor, capitalist and the business man, result in securing to the inventor, on an average, a larger portion of that to which he would be entitled under ideal conditions (such as never can be obtained) as would come to any other workman in our vast industrial army.

Patent Claims.

The current issue of *The Forum* contains an article by Mr. H. Ward Leonard entitled "The Legal Monstrosity of Our Patent System" which severely arraigns our present patent system. In opening it is stated that the individual who gets the least return for what he produces is the American inventor, which class, moreover, is becoming rapidly exterminated under existing conditions. The article considers in detail the subject of patent litigations, including the prohibitive cost to the ordinary inventor, the method of taking testimony and the manner in which the bench is handicapped in arriving at proper decisions. The portion of the paper relating to claims is abstracted below.

The author asserts that under the ingenious pretence that various changes were needed for the protection of the public, interested parties have molded the patent system until it now represents the maximum of complication and legal expense, and the minimum of protection to the inventor. The inventor is perfectly competent to disclose his invention, but under the present system full and complete and accurate disclosure by him is entirely inadequate. The invention must be described in a series of peculiarly worded claims, and unless this peculiar, unique method of expression be employed with absolute accuracy, the inventor finds that although he has produced his valuable invention after years of labor, and has disclosed it so that the world gets the full benefit of his labors, he is not *secured* in any way whatsoever by the Government.

The method claims must not be "structural," and the apparatus claims must not be "functional"; there must not be anything "obscure," or "vague," or "indefinite" in the language, which must satisfy perfectly some hypercritical novice of an examiner frequently just out of school. The claim which succeeds in running the gantlet of this absurd system must express absolutely and without the slightest inaccuracy, exactly what was originally invented, when, years later, the patent is before the court because the invention has at last been appreciated and the patent has been infringed.

To be sure, to draw such a claim is practically impossible, and probably no patent lawyer or patent examiner, or judge, or anyone else, could do it if the bare specifications and drawings were given him at the filing date; but the inventor, who is not a lawyer, nor a rhetorician, nor an etymologist, is expected to do this, or else when his patent finally is adjudicated he will find the United States Government through its Judiciary Department saying to him: "While it is true that your invention possesses great merit and many advantages, and while it is admitted that it has been a source of benefit to the public and of profit to the infringers, and it is unquestionable that your disclosure was 'full, clear, concise and exact,' so that those skilled in the art were readily able to, and did, secure the advantages of the invention, yet unfortunately for you we cannot *secure* you in anything at all, because the language used by your patent lawyer or you, even though it was suggested by the Patent Office itself, was worded not quite accurately enough to describe with absolute precision the exact invention you really made."

Furthermore, the pretence that these peculiarly worded claims serve to protect the public by automatically giving to everyone who reads the patent full and accurate knowledge of just what the scope of invention is, so that they can respect it, is fallacious and misleading. So far as the ordinary honest manufacturer or user is concerned, the *claims* might as well be in Sanskrit. The *disclosure* is understood perfectly by the manufacturer or skilled user, if it be one in his line of manufacture or use, but the *claims* he never understands until he reads the court decision, if even then. He makes no attempt to understand them. What he does, if he has any reason to think that he ought to consider the patent at all, is to consult his patent lawyer. And now we can understand why we have the system of claims. Nine-tenths of the cost of getting out a valuable patent is represented by the fees paid to patent

lawyers in their efforts to get the multitudinous claims which are finally obtained. And every manufacturer who wants to know where he stands as to this patent has to get another patent lawyer to interpret the claims. The Patent Office does not draw the claims nor does it interpret them. It merely says in effect: "Your invention is a new and useful one and your disclosure is perfect, but we do not like your use of language in the claims you have submitted. We know what you have invented, but we decline to assist you. We merely reject your application."

Evidently it becomes necessary to employ a patent lawyer to state in the unique language of claims a series of descriptions differing by very slight gradations and in different words. Some of them which the examiner erroneously says are all right will prove ultimately to be so broad as to be invalid. Others will be too narrow to cover with proper breadth the scope of the invention. It is conceivable that some one of these claims will, with perefct fidelity, describe the real invention, but probably this has never been realized in practice, in the case of a fundamental invention.

Since the scope of a patent can be correctly judged only by experts after the art has been fully searched, it seems manifest that the requirement for this unique use of rigid language in a long series of claims, unintelligible and uninstructive to the public, is an imposition upon the inventors and upon the public, and that the customary representation that our unique claim system is demanded for the benefit of the public, is not a fair one. No other Government demands claims such as are demanded by our Patent Office. In fact, such claims will not be permitted in patents of other countries.

As soon as suit is instituted on a patent, the infringers' lawyer says to the court that the patent contains an absurd number of claims, and the patentee should be forced to abandon his suit except as to two or three of them. The court sees the absurdity of considering the long series of slightly differential claims and forces the inventor at the start to pick out a few claims and rest his case on these, regardless of what the full development of the case by the testimony may show the real invention to have been. The inventor and his lawyer select a few claims, and usually are sorry afterward that they did not select some others, and frequently have to start all over again at a later date because the exact invention which he originated has been found to be better represented by another claim. Often the suit has to be abandoned because, although the invention was disclosed perfectly, the examiner erred in granting claims too broad in scope; and then it becomes necessary to hand the patent back to the Patent Office, and reissue it with narrower claims and start suit all over again.

Of course this all takes lots of time and money, but nevertheless the inventor in the "exclusive right" by a new grant the infringer has gets exactly the same benefit, due to the "new and useful result," irrespective of these claims. The Government gets new fees, "secures" the inventor in the "exclusive right" by a new grant, the infringer has eluded the inventor, and the patent lawyers are kept busy.

But the inventor—the only producer of anything of value and who has confided his secret to the Government, who in turn has disclosed it under promise of "securing" the inventor —what about him and his exclusive right? Usually about this time he is forced to the wall, and either enters the employ of the infringer at a small salary, or if the inventive part of his makeup is subordinate to his business judgment, he curses the whole patent system and turns his attention to other lines.

As to the typical inventor of new and useful things, whom the Constitution intended to encourage, and who if *secured* and rewarded by fame or fortune or both, would be apt to produce inventions of great value to the nation—what of him? Usually he is to be found in the employ of one of the trusts, under a contract which stultifies his intellect as an inventor during the period of his usefulness. He is drawing a small salary and not inventing much of anything, and as an independent inventor has been emasculated.

In concluding this section of his article Mr. Leonard says that "some day, and before long, there will be heard in Congress a statesman who will clearly point out the crime of the United States patent system, and then the intelligent public will wonder at the shortsightedness of Congress in permitting for so many years the strangulation by capital, and the weakening by ridiculous legal systems, of those whose prototypes have done most to advance civilization."

Operation of New Orleans Electricians' Licensing Law.

The enforcement of the Louisiana Electricians' licensing law, operative in New Orleans only, has resulted in numerous affidavits by a delegated member of the Board of Examiners and Supervisors against unlicensed men undertaking to do electrical work, upon information received usually from duly licensed contractors. Over a dozen men are committed on $250 bond to answer in a higher court, whose decisions in two cases are daily expected. These will either discourage those fighting the law, by upholding its constitutionality, or further enliven prosecution by the large number of contractors who have paid the fee and passed the examination. One man spent two weeks in jail before he was released, pending decision, for cleaning some ceiling fans in a hotel. One of the biggest hotels in the city was induced to send its engineer to take the examination, because workmen hired to make extensive repairs were not working under a master electrician's certificate. The contractors' association is encouraging the movement with a removal of its initiation fee, formerly $100, to bring all eligible licensed contractors within its fold. It is expected that one of the two cases now before the Superior Court will be carried to the Supreme Court of the State.

An Early Tungsten-Lamp Patent.

Mr. Turner D. Bottome, of Indianapolis, Ind., has called our attention to a tungsten-lamp patent just issued to him under date of April 9, 1889, on an application filed Sept. 29, 1887. This patent was assigned to the Rev. John B. Tibbitts, of Hoosick, N. Y., who about that period had become interested in electricity and obtained control of various electrical inventions with a view to their commercial development. His methods were such, however, that he met with no success in his efforts, and Mr. Bottome was not the only inventor who had a discouraging experience with the reverend promoter.

The specification of the patent recites that the invention relates to the treatment of the carbonized filament for the purpose of hardening and strengthening it; and consists in the various steps and manipulation and in the product. To carry the invention into effect any of the usual forms of carbon are used, such as are derived from baking various forms of vegetable fiber, among which linen thread, tampico or cocoa fiber are examples. After these fibers have been carbonized by baking, they are soaked in a saturated solution of tungsten trioxide dissolved in aqua ammonia or in any of the fixed alkalies. The filaments thus prepared are dried and then subjected to a high heat by incandescing them electrically in the presence of dry hydrogen gas, or the fibers may be saturated with a tungsten compound before baking or carbonizing and then placed in a crucible packed with carbon dust and heated to whiteness. In both instances the result is to reduce tungsten compounds to tungsten metal. The addition of tungsten to the carbon appears to produce in the filament a property similar to that conferred on steel by the addition of tungsten—namely, a great increase in hardness and strength. Obviously the soaking, drying and subsequent reduction of tungsten compounds to the metal may be repeated several times until sufficient quantity of tungsten has been incorporated with the carbon.

There are two claims to the patent, as follows:

1. The process of manufacturing filaments, consisting in

saturating a carbon filament with a tungsten compound and reducing such compound to metal tungsten.

2. An incandescent filament composed of metallic tungsten and carbon in varying proportions, for the purpose as herein described.

Mr. Bottome, who is now with the Keramic Supply Company, Indianapolis, Ind., writes that during his experiments he made some lamps taking 20 amp of current, and giving a flood of light exceeding that of the present flaming arc, and that he attained an economy as low as 1½ watts per candle with some of his experimental lamps.

Central-Station Newspaper Advertising in Boston.

In connection with the recent campaign of electricity against gas in the Boston street lighting negotiations the Edison Electric Illuminating Company made a striking use of newspaper advertising. The company found it necessary to place the facts before the public in the clearest feasible way, since wide publicity had been given to the unfair criticisms that had been launched against the company and the city officials who had decided that electricity offered advantages superior to gas for the service contemplated. The work of preparing the advertisements which were used was carried out under the personal supervision of Converse D. Marsh, consulting advertising expert of the Boston Edison Company.

The Boston dailies of May 3 contained full-page advertisements of the Edison Company which in each case reproduced word for word the report of Superintendent of Streets Emerson to Mayor Hibbard, reviewing the history of the investigation which led to the signing of the street lighting contract between the Edison Company and the city, and giving the actual facts and figures showing the superiority of electricity over gas. This report had been printed mainly in abstract in the afternoon papers of a previous date when Superintendent Emerson gave out the facts. The company showed that under the new contract the city of Boston will secure more light from each lamp than is obtained by any other city in the United States, and that Boston gets more light for less money than any other city in the entire country. On May 4 each paper contained an advertisement asking citizens of Boston to visit the Back Bay, where two street blocks on Commonwealth Avenue were lighted in competition by magnetite arc and gas mantle lamps at a respective yearly cost of $518 and $560. The company pointed out that no expert opinion was necessary to enable each citizen to judge for himself which is the better method of illumination.

On May 7 another advertisement was carried calling attention to a practical demonstration of modern lighting methods by the company in Copley Square on the evening of this date. Copley Square is the most noted art, religious and educational center in Boston, and for a number of years past has been lighted with seven Gilbert arc lamps costing $828 per year. At the date of the advertisement the square was lighted by three large flaming-arc lamps costing $468 per year. At 7:45 p. m., and again at 8:15 p. m., the flaming arcs were turned out for five minutes and the old Gilbert lamps lighted, so that the public could compare the two methods. It was pointed out what each method cost, and the statement made that this square is now better illuminated than the famous Brandenburger Square in Berlin, which has been considered the best lighted square in the world. When the time of the demonstration arrived a large crowd had collected, and the superiority of the improved methods aroused much comment. Several magnetite arc lamps of the 6.6-amp size, which will be used in the new street illumination under the 1909 contract, have since been installed on Boylston Street in the immediate neighborhood of Copley Square, practically on its edges. As a result of the company's open-handed manner of meeting the situation the agitation regarding the new contract has become a dead issue in Boston.

Meter Exhibit at the N. E. L. A. Convention.

Central-station men actively engaged in meter work or in the reorganization of meter departments will have an excellent opportunity to obtain the latest and best information on the subject from the exhibit which the meter committee proposes to make at the convention. During the past year this committee has received requests for information on various phases of meter work and in its report has endeavored to cover these points. Because of the difficulty of making all these points clear, however, and in order also to bring out features not covered in the report, the committee will install a working exhibit on the Million-Dollar Pier, adjoining the registration booth. The exhibit will include different types of meter installations; meters properly connected to demonstrate testing methods; instruments, tools and appliances for meter testers; shop and laboratory apparatus; together with photographs and printed forms received by the committee in reply to a circular letter, and other available data on meters and meter practice obtained from member companies. A number of practical and technical men will act as demonstrators, and in order that the committee may be of further benefit to member companies, cards will be provided for questions and suggestions from delegates and the subjects will be taken up later by the committee for consideration.

The Omaha Electrical Show.

The two accompanying views of the Omaha Electrical Show, held in that city May 6 to 15, illustrate some of the novel lighting features introduced there. Part of the decorative lighting was accomplished by revolving chandeliers, shown in the engravings, consisting of hemispheres of galvanized iron, each carrying 112 lamps. The hemisphere is so mounted that it can revolve freely and current is taken to the lamps through slip rings. The revolution of the hemisphere is very simple and easily accomplished by placing a fan motor on top out of sight from the main floor of the building and the discharge of the fan at

FIG. 1.—VIEW DOWN ONE AISLE, OMAHA SHOW.

a tangent to the arc of revolution of the hemisphere. This causes the chandeliers to revolve slowly without any apparent motive power. The effect was to lend a general tone of brightness to the auditorium. Some of the hemispheres were in motion at the time the photographs were taken and some were standing still. The hemispheres were 8 ft. in diameter and contained 16 ribs with 6 lamps on each rib and a ring of 16 lamps on the bottom.

Another novel feature of the show was a miniature train of cars which made regular trips around a ledge in front of the balcony. Fifteenth Street, leading to the Auditorium from

the principal east and west thoroughfares, was specially decorated during the show for a distance of two blocks by festoons of colored incandescent lamps. Excellent music was provided afternoons and evenings by Green's band, with Blanche B. Mehaffey, soprano soloist.

The Omaha Electric Light & Power Company occupied the stage of the Auditorium with an industrial power exhibit. The local supply and contracting firms, which largely made of the rest and thereby jeopardized their ability to partake of exhibits. These exhibits were an excellent selection of appliances calculated to arouse public interest. During the show period *The Electric World Daily*, "A Journal of Power," was published under the management of the contract agent of the Omaha Electric Light & Power Company, Mr. I. B. Zimman.

The evening of May 12 the Sons of Jove held a rejuvenation at the Elks' Club, at which 13 candidates crossed the burning sands. Four out of the 13 sacrificed themselves for the cause of the 13 and thereby jeopardized their ability to partake of nourishment in a sitting posture for a few days. It is not recorded that there were any fatalities. After the initiation there was a spread at the Henshaw. The rejuvenation was in charge of Mr. A. G. Munro, statesman for Nebraska.

One feature of the show was the popular experiments and

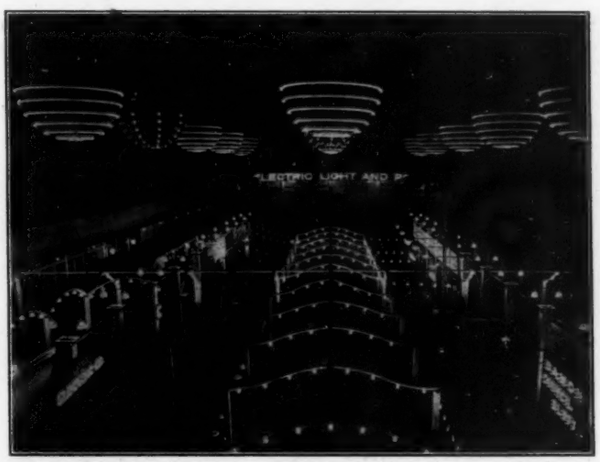


FIG. 2.—GENERAL VIEW OF OMAHA SHOW, SHOWING REVOLVING CHANDELIERS.

lectures carried on by Dr. Frederick H. Millener, experimental engineer of the Union Pacific Railroad. The decorative lighting of the show was turned on a number of times by wireless telegraph relays operating solenoid switches. On some occasions the wireless impulses for turning on the lights were received from Fort Omaha, four miles away, and at other times from a wireless sending station in the building. The apparatus employed was partly the same that Dr. Millener has been using in his experiments for transmitting wireless signals from stationary semaphores along the line of the Union Pacific Railroad to moving locomotive cabs.

The Omaha Electrical Exposition Company has a membership of 12 of the prominent supply and public service corporation men of Omaha, the officers being as follows: Mr. G. W. Johnston, president; Mr. A. G. Munro, vice-president; Mr. Wilgur L. Burgess, secretary; Mr. J. R. Lehmer, treasurer; Mr. F. A. Nash, chairman advisory committee; Mr. J. M. Gillan, manager; Mr. Waldemar Michaelsen, superintendent of light and power.

"Wireless" Activity Around the Great Lakes.

With Chicago as a center there have been of late manifestations of renewed activity in the district of the Great Lakes in extending wireless communication. A wireless station was lately installed on the roof of the Auditorium Annex Hotel, and on May 3, according to the daily newspapers, and as noted in the issue of May 6, the first wireless messages ever transmitted between New York and Chicago were received and sent at this station. The Annex station was installed by the United Wireless Telegraph Company of New York, which company also has a station in Cleveland and one at Benton Harbor, Mich., across the lake from Chicago. In Buffalo, as previously noted, it is building a station on the *Evening Times* building, and it is also promised that there will be a station in Detroit, although the location has not been decided. In Milwaukee there will be a station on the Pabst brewery, and the smokestack of this establishment, 230 ft. high, will support the aerial wires. The new St. Paul Hotel, in St. Paul, Minn., will have a station, and it is also planned to erect stations at Duluth, Minn., and on Mackinac Island. Another station is under construction at Grand Haven, Mich., on the east shore of Lake Michigan, and arrangements are practically completed for a location at Manitowoc, Wis., on the west shore of the lake. Other Lake Michigan locations for "wireless" stations will be Holland, Mich., and Petoskey, Mich. Eventually the United company plans to have nine stations on the shores of Lake Michigan.

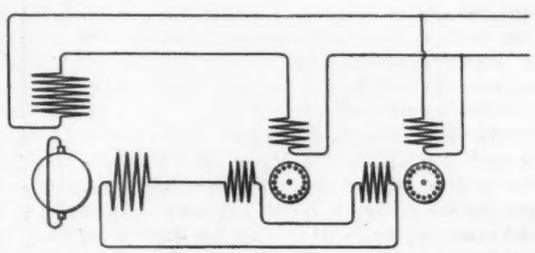
In addition to the land stations, the passenger boats of the Graham & Morton, Goodrich and Crosby steamship lines on Lake Michigan will be equipped for wireless. On the Canadian side of the Great Lakes negotiations are now under way with the Dominion Government for procuring licenses for "wireless" stations, which will be placed at Toronto, Sarnia, Collingwood, Owen Sound, Port Arthur and Fort William.

It is not the intention of the builders of these wireless stations to compete with ordinary telegraph lines, although commercial business will be accepted, it is said, and even solicited in some special cases where the nature of the business is especially favorable. The principal idea appears to be to enable passengers on lake boats to communicate with the shore at all times and also to provide a special means of communication for hotel guests. Tuning devices are used to prevent interference and it is thought that these will prove effectual.

In addition to the work of the United Wireless Telegraph Company in the Great Lakes basin, the Radio-Telephone Company of New York (DeForest and Stone systems) is erecting "wireless" stations for telephone service in the same area. The steel tower of this company in Chicago is placed on the tall Majestic Building on Monroe Street, in the "downtown" district, and is very conspicuous. It is said that the top of the pole surmounting this tower is 432 ft. above the street level.

Constant-Speed, Single-Phase Commutator Motor.

The arrangement shown herewith consists of a single-phase repulsion motor receiving exciting current from two single-phase induction motors used as tertiary-circuit generators for giving e.m.fs. in time-quadrature with the primary e.m.fs. The



LATOUR CONSTANT-SPEED ALTERNATING-CURRENT COMMUTATOR MOTOR.

primary coils of one induction motor are connected in parallel across the supply circuit, while the primary coils of the other induction motor are placed in series in the supply leads. The excitation of the repulsion motor varies to any desired extent with the load on the machine. This scheme was patented on April 20 by Mr. Marius C. A. Latour, who proposes to employ it for obtaining constant-speed characteristics in an alternating-current commutator motor.

Thirty-Mile Transmission from Steam Power Station at Galena, Ill.

Succeeding the Tri-State Light & Power Company, of Galena, Ill., the Interstate Light & Power Company, of Madison, Wis., has been incorporated with $400,000 common stock and an authorized bond issue of the same amount. The issue of preferred stock has not been determined as yet. The company will build a steam-driven generating plant at Galena to produce electricity which will be transmitted to several points in the State of Wisconsin, the length of transmission being about 30 miles. The station will have a capacity of about 3000 kw, and it is probable that steam turbines will be installed. The voltage of transmission will be 33,000, and electricity will be supplied for lighting Platteville, Cuba, Benton and Hazelgreen, Wis., the energy being sold at wholesale to the local lighting interests in the places named. In addition electricity for operating motors will be supplied to about 25 zinc mines in the vicinity. The officers of the company are: President, Mr. A. O. Fox, Madison, Wis.; vice-president, Mr. O. E. Osthoff, Chicago; secretary, Mr. M. F. Fox, Madison, Wis.; treasurer, Mr. Leroy E. Caldwell, Chicago. H. M. Byllesby & Company, of Chicago, are the engineers for the company, and the American Trust & Savings Bank, of Chicago, and other banks, are financing it. The Power Construction Company, a subsidiary corporation, will build the plant and turn it over to the Interstate Company.

The southwest corner of Wisconsin and the northwest corner of Illinois present a locality with many active and potential enterprises in the way of mining and manufacturing, and it is believed that this new power-transmission plant will be a decided help in the development of the region. The plant will be of especial interest owing to the unusual length of transmission from a steam power plant.

Energy Transmission Through Aerial Lead-Covered Cables.

The Niagara-Oswego Power Company, which was recently formed for distributing Niagara energy in Fulton, N. Y., is planning to install at that place a system of 6600-volt aerial lead-covered cables. Each cable will consist of three No. 6 stranded copper conductors insulated by cambric and protected with a lead covering. The cable will be suspended from a steel messenger wire similar in all respects to the method commonly used with telephone cables. The cable will be placed on the existing telephone poles and will provide the maximum of security with the minimum of constructive difficulties and maintenance cost.

Energy for these cables will be obtained through three 250-kw transformers, now in use at Baldwinsville, which will be placed in a substation to be erected in Fulton. These transformers will be connected to the 33,000-volt transmission lines of the Oswego River Power Transmission Company, which now reach from Baldwinsville to Fulton, and are being extended to Oswego, the poles for the additional line being already in position.

At Baldwinsville the Seneca River Power Company is arranging three 75-kw transformers to carry the load for which the larger transformers mentioned above are now used. By means of this transformer equipment, 25-cycle energy from Niagara is employed for operating lamps and motors in Baldwinsville. Tungsten lamps are in common use. That the service has been satisfactory is shown by the fact that the actual load has increased by about 30 per cent during the past year in spite of the substitution of tungsten for carbon lamps. Moreover, the low frequency has not been found objectionable, neither have the fluctuations in the voltage, although no voltage regulators have been installed.

In order to obtain high-frequency energy for arc-lamp circuits a 60-cycle generator is directly driven by a 25-cycle, 75-hp induction motor. Belted to this motor-generator set is a waterwheel utilizing a low-head fall in the Seneca River which formerly supplied energy for the lighting in Baldwinsville. Under normal conditions the gate admitting water to the wheel is left completely open so that it operates at a certain constant load. When the 60-cycle load exceeds the output of the waterwheel, the speed of the set decreases somewhat and the motor carries the excess load. When the high-frequency load decreases the motor load decreases also and may even reverse, in which latter case this machine is driven above synchronism and acts as an induction generator. In case the waterwheel is inoperative, the motor carries all of the 60-cycle load. The president of the above-mentioned companies is Mr. S. B. Storer, consulting electrical engineer, Syracuse, N. Y.

Duty on Mica.

In a letter to the *New York Times*, Mr. W. J. Gibson gives a history of mica tariff duties, and points out the unfairness of the present tax and that proposed in the tariff measure now before Congress.

Until 1872, he states, mica had not appeared in the tariff at all. In the act of 1872 and 1883 "mica and mica waste" were on the free list. It appeared for the first time on the dutiable list in the McKinley act of 1890 at 35 per cent ad valorem. In the Wilson act of 1894 it was made dutiable at 20 per cent ad valorem. In the Dingley act in 1897 a duty was imposed on it as follows: "Mica, unmanufactured or rough trimmed only, 6 cents per pound and 20 per cent ad valorem; mica, cut or trimmed, 12 cents per pound and 20 per cent ad valorem."

This language, he says, looks very innocent to the unsuspecting reader, but the result was to put a duty on some qualities of mica of 4000 per cent, or 40 times its value. This is what is known as a compound duty, a specific and ad valorem duty combined, and whenever it is resorted to it is designed to impose a very high duty on the article which is the subject of it. In the Payne and Aldrich bills the duty upon these qualities of mica has been reduced 1 cent a pound, that still makes the tax on the long ton over 3700 per cent, and 3333 per cent on the short ton.

In conclusion Mr. Gibson says there is no reason for a duty upon mica at all, as it is a product of nature and is easily taken out of the ground. This country consumes almost 10 times as much as can be found here, yet the lucky finders of this one-tenth are able to induce Congress to impose this outrageous protective tariff on this product of nature.

Tungsten Lamp Terminals.

A patent issued April 27 to H. Remané and E. Hurwitz, of Berlin, and E. Gottschalk, of Charlottenburg, Germany, relates to a bi-metallic tungsten lamp terminal. In the specification it is stated that at the present time the ends of the tungsten filaments used in electric lamps are attached to metallic supports by fusing the ends of the supports which, when they solidify, holds the ends of the incandescent filaments firmly in place. This method can be carried out successfully when platinum wires are used as the supports or current leads; but if nickel wires be used, frequent breakages will occur, caused by the formation of an alloy of a small portion of the nickel with the tungsten when the nickel ends are fused (by means of the electric arc). This alloy is itself readily fusible and causes a reduction in the sectional area of the filaments in the vicinity of the fused portion owing to the fusible alloy running down, and this causes the filaments to break readily at these weakened places. If copper be used for the supporting wire instead of nickel, another defect is caused by the filament breaking through and escaping from the surrounding fused globule before it has solidified.

The present invention relates to a means for obviating these inconveniences by using, as a filament support, a wire containing two metals, one being, for instance, copper itself or a metal

(such as silver) which behaves like copper, and a second, for instance, nickel or a metal (such as iron) of analogous behavior. It is important that one of the metals should readily form alloys with tungsten, while the other metal should not. A convenient means consists in using wires composed of alloys of the above-mentioned metals, though it is also sufficient for the two metals to be merely mechanically united, in the wires. For example, a wire can be used composed of nickel with a coating of copper, or a copper wire coated with nickel.

Street Lighting in Chicago by Energy from the Drainage Canal.

Every arc lamp maintained for street lighting in the city of Chicago by the municipal government is operated by means of electricity generated in the hydro-electric plant of the Sanitary District on the Chicago Drainage Canal, at Lockport, Ill., 30 miles from the center of the city. In all there are 11,670 street lamps maintained and operated by the Department of Electricity of Chicago, of which Mr. William Carroll is city electrician. Of this number 4958 are supplied with electricity generated in municipal lighting stations existing before the Drainage Canal plant was put into operation, and now operated by means of electric motors driving the existing generators, these motors being operated by electricity from the Drainage Canal plant.

Lamps to the number of 6712 are operated from new substations, the Drainage Canal energy being transformed to the requirements of the street-lighting circuits without the interposition of moving machinery. Two of these substations are located on the South Side, one at Emerald Avenue near Thirty-fourth Street, and the other on Wentworth Avenue near Forty-eighth Street. A third is on the West Side, on Wood Street near West Nineteenth Street. The Wentworth Avenue substation, which may be considered as typical of the practice which has been adopted in utilizing the high-potential energy from the Drainage Canal plant for street lighting, is illustrated and briefly described herewith:

This substation is a substantial and attractive building, erected of brick trimmed with Bedford stone, with reinforced-concrete roof and floors, supported by steel beams and cast-iron columns, with interior walls of white-enameled brick. The station is built in a thoroughly workmanlike manner and is fireproof.

The principal electrical apparatus consists of three 250-kva transformers, 30 regulators and the switchboard equipment for the incoming high-potential and outgoing circuits. Electrical energy is received from the Sanitary District at 12,000 volts, 60 cycles, three-phase, the e.m.f. being decreased to 4250 volts in the secondaries, as shown in Fig. 4. The primaries of the transformers are delta-connected, and the secondaries are star-connected. Fifty-lamp arc circuits are connected in multiple from these three transformers, there being nine on each phase of the secondary system, making 27 circuits from all of the transformers, or a total of 1350 lamps. The neutral of the star-connection of the secondary system is grounded. The

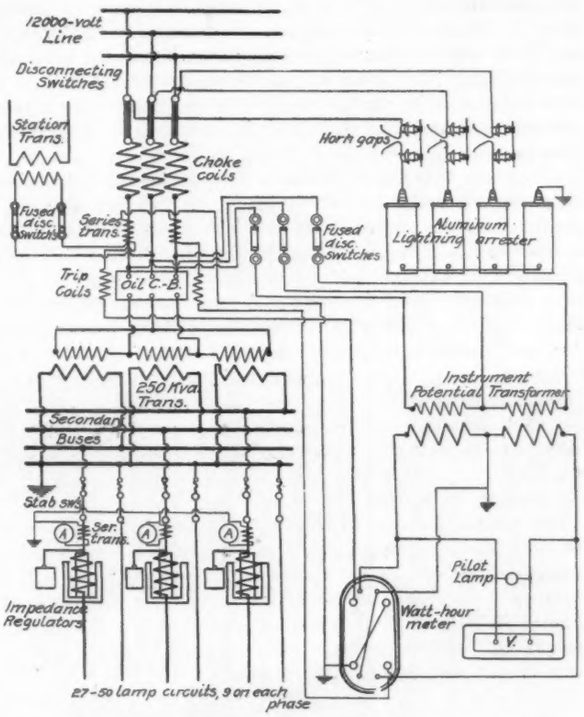
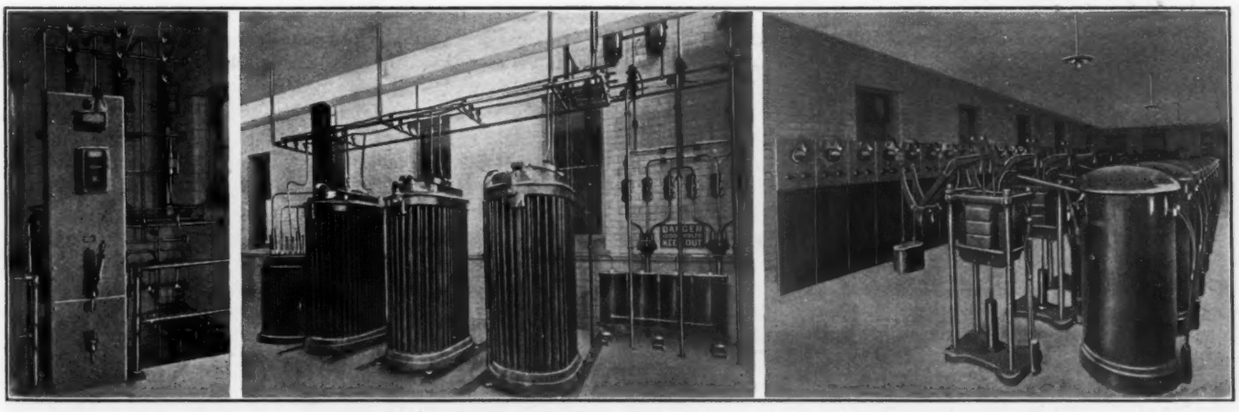


FIG. 4.—WIRING DIAGRAM FOR WENTWORTH AVE. SUBSTATION.

streets lighted from this substation extend from Thirty-ninth Street on the north to Fifty-fifth Street on the south, and from Grand Boulevard on the east to Halsted Street on the west. If the necessary money can be obtained by the authorization of a municipal bond issue, it is intended to extend the system of substation street-lighting to cover the whole city.

Use is made of 7.2-amp, alternating-current series enclosed-arc lamps with from 75 volts to 85 volts at the lamp terminals. The lamps will operate about 100 hours without requiring renewal of the electrodes. The lamp-posts are spaced about 225 ft. apart, as a rule, and the lamp is suspended 14 ft. above the sidewalk. Both overhead and underground constructions are used in supplying electricity to the lamps; where overhead construction is used an effort has been made, in the newer work, to render it as inconspicuous as possible. The lamps operate all night and every night, averaging about 8½ hours'

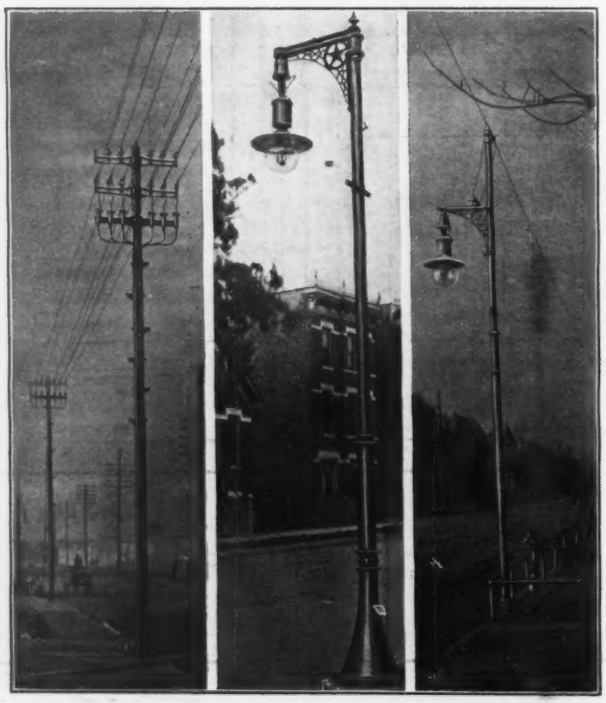


FIGS. 1, 2 AND 3.—VIEWS OF INTERIOR OF WENTWORTH AVE. SUBSTATION.

service in summer and 14 in winter, or an average of about 11 hours' use out of the 24 throughout the year.

The electricity used costs the city $15 per hp-year for night service. The Sanitary District offers electricity for day service also to factories and other motor users, endeavoring so to plan the load that there will be no overlapping between the demands of the private consumers and the starting-up time of the city electric lighting service. This result would seem to be rather difficult to accomplish in winter, but as the rated output of the Sanitary District generating station has not as yet been reached either for the day service or for the night service, no difficulty has thus far been experienced in making this arrangement.

Electricity for the Wentworth Avenue substation is taken from the Chicago terminal station of the Sanitary District at Western Avenue, near Thirty-first Street. It is brought into the substation through underground cables, and the incoming circuits are provided with aluminum-cell lightning arresters. The substation building consists of two stories, but the upper floor does not extend clear across the building, being, in fact,



FIGS 5, 6 AND 7.—POLE LINE AND LAMP-POSTS.

a wide balcony. Through the space thus left the high-potential circuit apparatus extends through the two floors, and this open space also provides room for a hand-operated crane of sufficient lifting capacity to handle the parts of any piece of apparatus in the building. The transformers are on the ground floor, while the regulators and switchboard for the outgoing circuits are on the upper floor or balcony. Here also is the high-potential control panel, so that the entire substation is operated from this gallery.

On the high-potential control panel is the handle for operating the main three-phase oil switch. There is also a Thomson polyphase meter, reading in kw-hours, and a voltmeter reading up to 175, but arranged to be multiplied by a constant of 100 to show the actual potential measured. At the bottom of this panel is a relay for operating the oil switch. All iron structures and all secondary circuits are grounded, and the whole installation presents a neat appearance both inside and out. All of the apparatus is of General Electric manufacture except one transformer made by the Allis-Chalmers Company, which is temporarily installed for the purpose of lighting Gage Park.

There are 30 constant-current, 50-lamp regulators on the balcony floor. Fifteen of these are air-cooled and 15 are oil-cooled. Adjacent to these is a 30-panel circuit switchboard provided with stab switches working in fiber tubes, each tube being equipped with an expulsion fuse. The panels of this board are of blue Vermont marble, each equipped with an ammeter reading up to 10 amp and two apertures for the stab switches, the negative bus being grounded. Plenty of room is provided at the back of the board, which is easy of access. The outgoing circuits are led from the substation in eight-conductor cables.

The substation machinery is operated by one man, but as the building is open continuously three men are needed, relieving one another in eight-hour shifts. The two night men do the operating, the duties of the day man being rather those of a custodian and watchman. The first night man goes on duty at 3 p. m. and stays until 11 p. m., his successor going on at 11 and going off at 7 a. m., when the day man goes on duty. The number of street arc lamps now actually operated from this station is 1303, but the ultimate output of the station, with the present apparatus, is sufficient for 1500 lamps.

Telephone Company Not an Accessory to Fire Department.

A recent court decision has held that a failure to give connection with a fire-engine house was not a ground of liability to the owner of a building destroyed by fire. A lumber company owning a plant at Lebanon, Ky., brought an action against the local telephone company, of which it was a subscriber, to recover damages for the loss of its plant by fire. When the night watchman discovered the boiler house to be on fire some time after midnight he at once rang central for the purpose of telephoning the alarm to the engine house, but the central office failed to answer his call, and it was only after he had made repeated efforts, during an interval covering some 20 or 30 minutes, that he succeeded in getting central to answer and furnish the needed connection. In the meantime the fire had gained such headway that when the fire department reached the scene it was beyond control and the buildings and their contents were totally destroyed. The petition did not charge that the defendants were under any contract with the city of Lebanon to maintain a fire-alarm system in the city, and hence their liability had to be determined under their general contract with their patrons. They agreed to furnish connection between the patrons upon request and subject to such reasonable rules as might properly be adopted and enforced in a town of the size of Lebanon. It was held that the facts upon which a recovery was sought were entirely too remote and speculative to support the cause of action, and a judgment for $10,000 in favor of the plaintiff, secured in a lower court, was accordingly reversed. The mere fact that the defendant company's operator was negligent in the discharge of her duty, and plaintiff suffered a loss, were not sufficient to create a liability; but there must to negligence and loss be added a state of facts showing that the negligent act was the proximate cause of the loss. The court reasoned that, in order to find for the plaintiff, it would be necessary to presume that the watchman in the engine house was awake and at his post of duty ready to answer the call immediately upon receipt of the notice of the fire; that he would at once have sounded the alarm by ringing the bell; that upon the ringing of the bell the members of the fire department, whether paid or volunteers, would have heard the alarm and promptly responded to the call, and would have reached the scene of the fire before it had spread to the main buildings. The fire-fighting apparatus must have been in perfect working order, and the fire department must have succeeded in confining the fire to the boiler house, and put it out before it had spread to the other buildings. The court held that when it is considered that each of these separate agencies is wholly inde-

pendent of the other, and none of them under the direction or subject to the control of the defendants, it is readily seen that in order to hold that the negligence complained of was the proximate cause of the injury or loss, a series of unallowable presumptions must be indulged in.

New York Public Service Commission News.

The Board of Estimate of New York City has not as yet acted upon the application of the Hudson & Manhattan Railroad Company for a franchise under Sixth Avenue from Thirty-third Street to Grand Central Station. The matter was referred to a special committee, but it is expected that it will be granted at the next meeting of the board. Mr. Frank Hedley, general manager of the Interborough Rapid Transit Company, has written a letter of protest claiming that the extension of the McAdoo tunnel will interfere with the completion of the plans of the Steinway tunnel company.

The Public Service Commission of the First District of New York has ordered that all subway express trains must be equipped with side doors. The question as to whether the doors shall be in the center or at the end is left to the convenience of the company. Center doors will be installed.

Mayor McClellan has signed the Travis-Robinson bill which permits the construction of rapid transit lines by private capital.

At the general investigation into the affairs of the electric lighting companies by the Public Service Commission last week, the question of franchises was again taken up. Mr. C. F. Matthewson, representing the New York & Queens County Electric Light & Power Company, testified that his company was operating under a franchise granted by the Council of Long Island City in 1894 and that at the present time it was the only company authorized to do business in that portion of Greater New York. With regard to that portion of the city which had formerly been the village of Flushing, Mr. Matthewson said that his company operated under a franchise granted to the Flushing Electric Light & Power Company—since absorbed—by the town trustees on Jan. 19, 1897. The right to operate in the villages of College Point and Whitestone were acquired in the same way, through franchises granted to the Flushing company. The rights to operate over the county roads in this section were in every case obtained in the shape of permits from the boards of supervisors and highway commissioners. These grants were for the most part for terms of 25 years from date, with renewal privileges. He said that his company held franchises from both the highway commissioners and board of supervisors for the territory that was formerly the town of Jamaica and also for the territory that was subsequently included in the village of Richmond Hill. These franchises for the most part extended for 45 years from different dates in the year 1896. In some portions of Richmond Hill the company is operating on grants given by private land owners. Mr. Matthewson claimed that if there was any doubt as to the rights of his company in this section, under the grants referred to, the invitation and acquiescence of the authorities to the company's operations for a period of 13 years furnished sufficient authority. Mr. Matthewson said that so far as possible the electric lighting business and the gas business had been separated in this territory and that whatever rights with regard to the latter his company had acquired had been leased to the New York & Queens Gas Company.

Party-Line Telephone Systems.

A step-by-step party-line telephone system on the group plan has recently been patented by Mr. A. J. Farmer, of Detroit, Mich. The branches of the party line are all carried to some central point remote from the central office, where there is located a special step-by-step device for connecting the stations together as required. Currents working in unison over the two sides of the main line advance the switch, while currents over one side bring it back home.

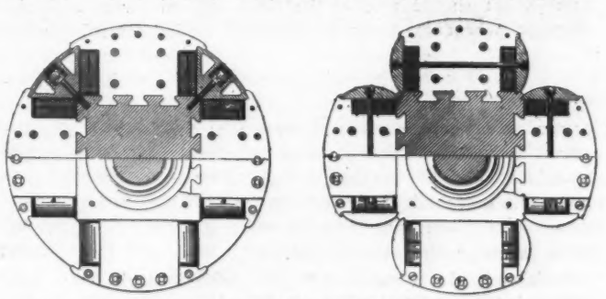
Private Use of Electric Automobiles.

The late Charles T. Hughes, who was always deeply interested in transportation, and who in the early eighties had charge of Mr. Edison's electric railway experiments at Menlo Park, became an automobile enthusiast during recent years, and up to the time of his death last week enjoyed nothing more than the use of his electric machine. The free locomotion that it gave him seemed to offset entirely the inertia that would otherwise have been inflicted upon him by invalidism. In an interview with the writer a few weeks before his fatal attack of pneumonia he said: "I have had an Edison storage battery in one of my cars for about four years. I was sick one year and did not use it very much, but I have used it three years every day, at least three hours, rain or shine. About four or five months ago I noticed that the voltage did not keep up, so I took it to the storage battery people. They discharged it, looked it over, and found that the batteries were a little out in some way and they fixed it up. With that exception, the battery is exactly just as good to-day as the day I put it in. I do not give it any attention myself. I have depended entirely upon a very ordinary, and I might say, ignorant, colored man, who has done everything with it that has ever been done. There has been absolutely no trouble to me. The man has done what was necessary. For eight months I was under the impression that the battery ought to be filled with distilled water every three weeks. I happened to look at the notice on the door of the garage at Llewellyn Park as to the care of Edison storage batteries, and saw it ought to be filled once a week. Then I changed my practice.

"I do not know how much mileage I could get. Of course I go up hill and down. I think my machine will make about 12 miles an hour. I have frequently been out four hours, and as much as 4½ hours, running all the time. I think I can get 50 miles easily on a level to-day."

Revolving-Field Magnet Structure.

In a patent granted to Mr. B. A. Behrend, on April 20, it is stated that the centrifugal stresses to which a revolving disk is subjected are greater at the center than at the edge and the maximum local stress is greatly increased when a hole is placed at the center of the disk. The inventor proposes to construct the revolving shaft of a high-speed generator so as to be free from all joints. The ends of the shaft are tapered so as to provide practically uniform strength to all parts, while the shaft itself is made of high-permeability steel and serves as a portion



FIGS 1 AND 2.—BEHREND REVOLVING FIELD CORES.

of the magnetic path. The core is rectangular in cross-section and is provided with dovetailed slots for supporting the pole pieces, as shown in Fig. 1.

Fig. 2 shows a modified arrangement for which a second patent was issued to the same inventor on the same date. According to the latter arrangement, the field coils are held in place by slab-shaped plates bolted through the pole pieces; in the former, use is made of wedge-shaped pieces inserted between the pole pieces for supporting the sides of the field coils. In each case dovetailed end-pieces serve for supporting the ends of the field coils.

Meeting of the Arkansas Association of Public Utility Operators.

At the second annual meeting of the Arkansas Association of Public Utility Operators, held at Hot Springs May 12-14, practically all of the lighting and railway companies in the State were represented, and many supply dealers were also in attendance. Upon the opening of the first session, President D. A. Hegarty in the chair, Secretary J. E. Cowles rendered his annual report, in which he gave details of a publicity campaign during the past year, in which more than 3000 documents having relation to the legislative situation were distributed among the public utilities of Arkansas. President Hegarty followed with his address, in which he pointed out that the organization is unique in that its membership includes all of the public utility concerns in the State, private and municipal, with the exception of telephone companies. He made a plea for fair treatment of public utilities, and referred to the fact that during the legislative session just closed a number of measures were introduced including drastic and contradictory laws against public utility companies, every one of which, however, was defeated.

The first paper was presented by Mr. J. M. Hewitt, president of the Marianna Electric Light & Power Company, entitled "The Relation of Public Utilities to the Public." The author contested the right of the public to control over corporations to which it has granted franchises. He said that the public cannot claim the right to regulate the rates of utilities, for if their business is being operated upon a profitable basis the returns are largely because of economies introduced in the management, which in the case of government operation the public would not be able to obtain. The rates, he contended, regulate themselves, and tend to go down as the demand goes up.

Mr. S. F. Dibble, of the General Electric Company, presented a paper on "The Sale of Motors by Central Stations," in which he advocated that lighting companies should control the sale of motors to be placed on their circuits. He held that in the last analysis the sale of motors and all current-consuming devices is the province of the central station, and must remain so; but if any lighting company in a small town is inclined to co-operate with a local dealer, the latter should be required to exploit the particular make of motor selected by the company, while in larger places where there are several dealers, and where it is advisable to handle different makes, the central station should absolutely prevent the sale of motors not of the highest grade. The central station should be advised by the dealer of all prospective purchasers, should assist as much as possible, but should reserve the right to deal direct with the customer whenever deemed advisable. The central station is in a much more favorable position to sell motors than the dealer, for while the latter is actuated solely by the profit on the sale of the motor, the central station can have no reason for recommending a certain motor except the desire to furnish a machine which will give the most satisfactory service. He strongly advised the central stations to sell only one make of motor, and that made by the company which is spending dollars where other manufacturers are only spending cents in improvements in design and construction.

At the second session Mr. J. E. Cowles, electrical engineer of the Little Rock Railway & Electric Company, read a paper on "Tungsten Lighting." The question to him appeared to be not whether central stations can afford to introduce the tungsten lamp, but rather whether they can afford to reject it. Many companies are too apt to consider only the immediate effect on their income of a change, rather than the future effect through satisfaction to present consumers and inducements for obtaining new ones. The new lamp enables the central station to compete with gas, and it has met the former frequent objection to electric lighting as being too expensive. Mr. Cowles stated that the property with which he is connected has recently displaced gas in many residences by means of the tungsten lamp. He considered that the central station and not the contractor should supply the tungsten lamp, as the former can furnish them more cheaply. His company furnished the first installation at cost plus 10 per cent, and renewed at cost plus 5 per cent, which latter will always cover breakage if lamps are properly handled. In the case of a prospective customer using another illuminant, it has been found satisfactory to install tungsten lamps on 30 days' trial. As an illustration of the long life of the tungsten lamp, Mr. Cowles called attention to a 250-watt tungsten lamp in the hotel where the meeting was held that had been burning more than 5000 hours and was not yet blackened. It had been turned off but once since it had begun burning, and as there was an engine on the floor directly above it, the conditions were not ideal for long life. In the discussion which followed, Mr. George D. Rosenthal, of the General Electric Company, said that instead of small lighting companies having experienced a reduction in income through the introduction of high-efficiency lamps, the opposite was true, as these lamps had supplied a competitive weapon, and this, with the better service, had resulted in nearly every instance in a larger connected load. He recommended that central stations should handle or sell all high-efficiency lamps in order to secure the best results. He urged solicitors to talk better illumination and not lower bills when urging customers to use tungsten lamps.

Mr. W. H. Walkup, manager of the municipal plant at Searcy, read a paper on "The Operation and Management of Small Central Stations of 250-kw or Less," which went into the details of routine operation and business management. He strongly advised that the superintendents of municipally operated plants should be given much more latitude than is usually the case. He said that at present the control of such plants was usually monopolized by a board, much to the detriment of the plant. He also strongly favored meter rates for small plants, and pointed out in detail the objections to the flat rate. In the discussion several members criticized the conduct and service of municipal plants in Arkansas. A recommendation that all meter testing should be done at the plant was contested by Mr. Cowles, who said that wherever possible such testing should be done on the customer's premises. Mr. L. E. Gould, associate editor of the *Electric Railway Journal*, reviewed briefly the meter-testing rules of the Wisconsin Railway Commission, which body, among other things, required that all meters be tested on the customer's premises at stated intervals. Since this rule has been put into effect one company had found that the saving in former unmetered current had more than paid the wages of the meter employee necessitated by the rules.

In connection with the Question Box, the subject of buying coal on specifications was discussed. President Hegarty said that Arkansas coal contained from 15 to 20 per cent ash, and that if it were bought on specification a penalty or bonus could be fixed according to whether the ash contained was greater or less than the specified percentage. The Little Rock and Pine Bluff companies had tried to induce coal dealers to sell according to specifications based upon those of the United States Geological Survey, but the dealers refused because there was a market available which did not make such close scrutiny of the fuel. Mr. Hegarty suggested a penalty of 10 cents per ton for every increase of one-quarter of 1 per cent of sulphur. Concerted action on the part of public utilities in the State was urged, in order to bring force to bear on coal dealers, and a committee was appointed to study the situation and draft specifications. Mr. Fred T. Benson, of the General Electric Company, presented a paper on "Tungsten Sign Lighting," which referred particularly to the new 4-cp, 5-watt tungsten lamps of 10 to 12 volts, which are burned 10 in series on direct-current circuits, and used in multiple on alternating-current circuits, with a transformer having a 10-to-1 ratio.

The following officers were elected for the ensuing year: President, Mr. B. C. Fowles, general manager Pine Bluff Corporation; first vice-president, Mr. J. M. Hewitt, president Marianna Electric Light & Power Company; second vice-president, Mr. S. A. Stern, Home Water Company, Little Rock; third vice-president, Mr. C. T. Griffith, general superintendent Little

Rock Railway & Electric Company; treasurer, Mr. E. T. Hardin, superintendent Hot Springs Street Railway Company; secretary, Mr. J. E. Cowles, electrical engineer Little Rock Railway & Electric Company. It was announced that the next meeting would be held at Pine Bluff, Ark., in 1910, the exact date to be fixed later.

Nebraska Electrical Association Convention.

The Nebraska Electrical Association held its second annual convention of the electric light and power men of the State at the Millard Hotel, Omaha, May 11, 12 and 13. The second annual electrical show, promoted by the electrical interests of Omaha, was in progress at the Omaha Auditorium during this time.

The first session of the convention was called to order by President E. A. Bullock, of Norfolk, on Tuesday afternoon at 2.10. Mayor James C. Dahlman, of Omaha, give the address of welcome, which was replied to by President Bulllock. As Mr. William Bradford, of Lincoln, the secretary, was absent on account of sickness, Mr. T. H. Fritts, of Grand Island, was appointed secretary pro tem.

President E. A. Bullock in his address called attention to a misconception that had arisen in some quarters which was in effect that the association was an organization for raising or establishing uniform rates over the State. Such an object was impossible of attainment. The only object of the association is mutual improvement of member companies through exchange of ideas and information. On account of the high cost of coal in Nebraska, the solution of engineering problems in connection with central stations is not the same in many other neighboring States. Nebraska stations have also to deal with a more progressive class of consumers than some further east, which introduces other problems.

Mr. Bullock suggested that co-operation of the smaller stations might be practised to advantage as regards two matters. One of these is in trying out new devices. For one plant to try out all the new things is out of the question. But a new appliance coming out could be tried out in two or three stations and some other appliance in two or three more and so on, each station communicating its experience to the others and so accomplishing in a short time at small expense something that would otherwise cost much more. There is no reason why all should be buying experience of this kind independently. The other suggestion for co-operation attracted considerable attention and favorable comment later, which was that small stations combine in the employment of a contract agent or new business solicitor of high grade who would organize a department for serving all the companies participating.

Commenting on the action of the association last year in voting to take in municipal plants, he thought this action wise. He expressed himself strongly on the obligations that a franchise imposes on the company receiving it even though not definitely expressed in the document. One of these is that of giving adequate service and keeping up with the growth of the town. Another is that of giving reliable and continuous service. High rates he considered more dangerous to the owners of the plant than to the public, because they tend to restrict the number of consumers and gross revenue. As a matter of public policy, street lighting should be done at nearly cost. He called attention to the charge that in connection with the regulation of public service companies profits will be restricted to 6 per cent on the investment. If this is to be the rule, there is no more incentive to the owners of a private plant to show enterprise in developing the property and introducing economies in operation than in the case of a municipal plant. Whatever they do there is only 6 per cent for them. He asked the question: "Are we to settle down to a municipal-plant method of operation?"

Mr. M. P. Ellis, of the Holophane Company, read a paper on the "Relation of the New Prismatic Reflector to the New High-Efficiency Units." This was followed by a short discussion. Mr. William Bradford was on the program at this point for a paper on public service legislation, but on account of his illness Mr. B. C. Adams appeared in his place. He read at length from an address of Mr. Henry L. Doherty before the Wisconsin Gas Association last summer which appeared in these columns. This dealt mainly with the issue that there is a value in a public service property which is in addition to its physical or tangible value and which is not represented by the franchise value. This is the value put into the property by good management and enterprise and is represented in the ordinary business by good will and by the cost of organizing and starting the business and building up a force of employees and methods of conducting the business. Mr. Adams in conclusion said that in Wisconsin the public service companies were co-operating with the commission in all ways. He recommended that Nebraska companies keep posted on commission legislation proposed. There was considerable discussion of the public service commission bill which had failed to pass the last Legislature.

Mr. W. J. Scott, of Kearney, thought this matter of a public service commission one of the most vital issues before the convention. He pointed to the good working of the law in Wisconsin. The Wisconsin commission in cases brought before it would not allow a business to be conducted at a loss. In some cases an increase of rate had been ordered. A State commission stops the bickering that may occur between a company and a city council. The city council then has no right to say that a company shall not charge more than so much without regard to cost. Mr. Joel M. Roberts, of York, thought that a company would be more likely to get better treatment from a commission than from a city council. Mr. B. P. Egan, of Nebraska City, was favorable to the commission idea. Mr. H. A. Holdrege, of Omaha, thought it proper to delay endorsing a public service bill or the general idea. He was not favorable to turning over matters to the present Nebraska Railroad Commission as had been proposed. Mr. E. J. Sullivan introduced a resolution for consideration at a later session favoring a public service commission. Mr. B. C. Adams, of Lincoln, uttered a word of warning to the effect that everything depends on the kind of a public service bill adopted. A blind endorsement of anything bearing the name may make trouble.

President Bullock urged central-station men to "get the unfairness out" of their systems and then to proceed to secure such a public service commission as will be fair to everyone concerned.

The meeting adjourned to convene at the Electrical Show at 6 p. m., whence the party proceeded to Hanson's café where an elaborate banquet was served by the courtesy of the Omaha Electrical Exposition and the Omaha Electrical Club. The toastmaster was Mr. George W. Johnston, of the Johnston Electrical Company, of Omaha, president of the Electrical Exposition Company. Those responding to toasts were Messrs. B. P. Egan, of Nebraska City; Waldemar Michaelsen, city electrician of Omaha; Joseph Thomas, of the Capital Electric Company, of Denver; A. G. Munro, of the Nebraska Electric Company; E. J. Sullivan, of Omaha; Geo. D. Loring, of the Shelby Electric Company; F. H. Brooks, of the Lincoln Traction Company; Edward F. Schurig, of the Standard Electric Company; J. M. Gillan, manager of the Electric Show, and E. A. Bullock, of Norfolk, president of the Nebraska Electrical Association. The Elks' Quartet gave a number of selections between toasts which were well received.

Wednesday morning's session was opened with the appointment of an auditing committee and a nominating committee. Mr. L. J. Schwengel, of Holdrege, read a short paper descriptive of an absorption system ice plant that his company has placed in operation at Holdrege. This utilizes the exhaust steam of the light and power engines and is producing 25 tons of ice for each additional ton of coal over and above what the plant formerly used before the ice-making plant was installed. The reliability of these figures was questioned by some of the other members operating ice plants, although the superior efficiency of the absorption system as compared with the compression system of refrigeration was admitted. Mr. Fritts, of Grand Island, reported making four tons of ice to three tons

of coal with an independent steam-driven compressor. Mr. Bullock, of Norfolk, reported making five tons of ice to one ton of coal with an independently motor-driven compressor and furnishing steam for the reboiler in the ice plant.

Mr. E. A. Bullock gave an informal talk on economy of operation, taking as his text a letter recently received from a member on the importance of the percentage interest on investment as to the cost of production. He urged members to go slow about throwing out good and reliable apparatus to put in more economical apparatus. It is all right to put in economical apparatus when extending the plant for the purpose of carrying the greater part of the output, he said, but keep the old apparatus for emergencies and peaks. Considerable discussion followed.

At the Wednesday afternoon session Mr. E. J. Sullivan brought up the resolution favoring a public service commission. After some discussion this was tabled, as it was not considered advisable to commit the association without knowing the exact nature of the bill proposed, and the Legislature does not meet until after the next convention of the association.

On motion of Mr. H. A. Holdrege, of Omaha, it was voted to appoint a committee to consider the advisability of affiliating with the National Electric Light Association in accordance with recent changes in the rules of that body. The president appointed Messrs. H. A. Holdrege, of Omaha; B. C. Adams, of Lincoln, and B. P. Egan, of Nebraska City.

A paper was read by Mr. H. C. Porter, of Omaha, on new business-getting which, with the long discussion which followed, took the remainder of the afternoon.

The nominating committee submitted its report of nominations for officers for the coming year, and the following officers were elected:

President, Mr. B. C. Adams, of Lincoln; vice-president, Mr. Joel M. Roberts, of York; secretary, Mr. Frank McMaster, of Beatrice; treasurer, Mr. L. J. Schwengel, of Holdrege. Executive committee: Messrs. E. A. Bullock, of Norfolk; B. P. Egan, of Nebraska City, and W. J. Scott, of Kearney. The place of next meeting was discussed and invitations were received from both Lincoln and Omaha. The matter was finally referred to the executive committee. On special invitation from the chair, Mr. Frank McMaster, of Beatrice, gave an account of the work done at Beatrice recently in checking over customers' meters and looking over installations to see that they are getting the light that they should for the money.

The president-elect, Mr. B. C. Adams, is general manager of the Lincoln Gas & Electric Light Company. His early training in central-station work was received in connection with the properties in which Mr. Henry L. Doherty is interested. Before going to Lincoln he was connected in various capacities with the Madison Gas & Electric Company. In 1906 he went to Lincoln as superintendent of the electrical department of that company. In 1906 he served as secretary of the Northwestern Electrical Association. He is an able representative of the most modern type of central-station manager, schooled in methods of analysis which are calculated to get the most out of central-station investments.

Annual Convention of Indiana Telephone Men.

The fourth annual State convention of the Indiana Independent Telephone Association was held in the Claypool Hotel, Indianapolis, May 12 and 13. Supply men occupied one whole floor of the hotel. President C. S. Norton in his annual address, in reviewing the work of the year, said the association had largely increased its membership and that only a few of the 454 Independent telephone companies in the State remain unenrolled. The number of Independent telephones added during the year brought the total up to more than 221,000. Toll business has increased until the messages are averaging 100,000 a month, the receipts amounting to $23,000. This is an excellent showing from the 100 companies now in the Clearing House, which has been in operation since last August. Mr. Norton pointed out how a division of the toll was made on a mileage basis, the authority for making the rates being vested in the Clearing House Association. He warned the managers of telephone companies to prepare to come under the jurisdiction of a public utilities commission, which, he said, would certainly be enacted by the next Legislature and which he believed would be beneficial.

Secretary Allen J. Payton, in submitting his annual report, declared that the granting of a new 30-year franchise with increased rates to the Indianapolis Telephone Company had put new life and vigor into the Independent movement throughout Indiana, and assured that the Bell people would not gain control of the telephone business in Indianapolis—a central point essential to the Independents. The reports from the district vice-presidents, without a single exception, showed material improvement and gratifying increase in business.

The annual dinner was an enjoyable occasion to more than 200 telephone men and guests. The subjects on the program for after-dinner talks may as well have been left blank, since only a few of the excellent speakers stuck to the subject assigned. City Attorney C. D. Bowan declared emphatically for a single telephone system, where possible, under proper restrictions. This declaration brought out a hearty discussion by other speakers who universally agreed with Mr. Bowen provided the single system was the Independent system. Mr. James S. Brailey, Jr., who is at the head of the largest Independent companies in Indiana and Ohio, talked on "Telephone and Other Securities," and asserted that, compared with other public service companies, the Independent telephone companies have far less water in them, and as a rule the securities represent actual investments. He declared that the stability in earnings was sufficient to place and to keep telephone securities in more active demand than any other securities. He insisted that the strength of the Independent companies was found in the fact that they were home-owned—80 per cent of Independent telephone property and stock being owned by home people. Messrs. M. L. Clawson, Will R. Hough, A. J, Payton, E. M. Wasmuth, N. G. Hunter, Theodore Thorward and F. O. Cuppy made characteristic after-dinner talks, each taking occasion to declare the position of Independents safe and impregnable. Mr. James. P. Goodrich presided as toastmaster with grace and dignity.

The morning session of the second day was opened by an interesting and instructive talk on "Telephone Laws and Legal Decisions," by Hon. Thomas E. Davidson. Mr. Davidson pointed out just what rights the companies had under a number of conditions and circumstances constantly arising. He advised telephone companies to employ good attorneys to advise and keep them out of trouble. "Extent, Limit and Rate for Party-Line Service" was a subject assigned to Mr. Thos. D. Sheerin. Mr. Sheerin, though a young man, made a good impression and is thoroughly familiar with his subject. He pointed out that the earnings of party lines were much greater than single lines when cost and maintenance were compared. He declared that it was generally admitted that country service was furnished at a less cost, and even though the party-line rate is lower, the country patron is better pay and in the end the party lines were the better revenue getters.

Mr. Walter J. Uhl read a paper on the advisability of paying for extensions out of earnings. Mr. Uhl said the practice is not a good one and is conducive to trouble, especially while the present low rate is maintained. He advocated that dividends be paid out of earnings, after the necessary reduction had been made for depreciation and repairs, and urged the safer plan of extensions being made by the sale of new stock rather than by bond issue. With proper capitalization and payment of dividends on it, telephone securities could thus be made standard, and a steady demand for them could be maintained. Mr. J. W. Coffey read a paper on "The Clearing House," giving in detail a full account of its organization, purposes and utility. Mr. Coffey declared that the clearing house was absolutely essential to the future life and prosperity of Independent telephony and predicted that within two years every company in the State would be a member.

The present officers, Messrs. C. S. Norton and J. W. Payton,

president and secretary respectively, were re-elected. The next annual convention will be held in South Bend, where the annual meeting of the Michigan Association will be held at the same time. Some of the sessions of the two bodies will be joint meetings.

The Successful Engineer.

In a recent paper Mr. F. C. Sargent, electrical engineer of the Malden, Mass., and several allied central-station companies, considered the elements of success of the engineer. A man who knows only how to do certain things, but does not know why they are done so, usually remains, he said, in a subordinate position. He must get the habit of analyzing and must also have his knowledge systematized. Imagination is also essential to the engineer—a constructive, creative imagination tempered by experience and good judgment. An engineer who cannot see beyond the present is not a safe guide.

One finds that the engineer who makes the biggest income and who occupies the most important and responsible position is the one who has the most business or practical knowledge. Our leading consulting engineers do not spend a large portion of their lives plotting curves, making tests or even making anything more than simple calculations. They spend their time dealing with large questions on purely commercial lines, and, as a rule, the bigger the engineer, the more he knows about practice and business, the less he knows about text-books and science. In his relations with his employer, the engineer must act in his capacity as an investigator, a counselor and a judge. It is his duty to his employer to keep himself informed as to the most modern methods of engineering, and if possible to show them wherein economies may be made. On the other hand, an engineer's employer should consult him in reference to all matters pertaining to engineering, such as standardization of apparatus, whether proper terms and amounts have been used in contracts, approval of forms, in reference to policy on changes of methods of manufacturing, distribution or new apparatus. These consultations should be with the executive heads as much as possible, as many times, when an engineer's recommendations are given second-handed, there may be some vital fact lost sight of that would make a great difference in the ultimate cost.

Instruction in Illuminating Engineering.

The May meeting of the Chicago Section of the Illuminating Engineering Society was held at noon on May 13 at a downtown hotel. After luncheon Vice-President George C. Keech, who was in the chair in the absence of Chairman J. R. Cravath, announced the appointment of a nominating committee to propose the names of officers for the Chicago Section to serve for one year from June, 1909. The members of this committee are Messrs. William E. Keily, M. E. Terbush and Charles A. Luther, People's Gas Light & Coke Company.

Prof. W. E. Barrows, of Armour Institute of Technology, Chicago, read a paper on the subject of "Instruction in Illuminating Engineering" at that institution. He first outlined the need of the illuminating engineer and the importance of the work, asserting that perhaps $25,000,000 a year is wasted in this country in uneconomical and inefficient systems of illumination. In September, 1907, a short course relating to the principles of illuminating engineering was established at Armour. It was given to senior students and consisted of notes of instruction, principally from technical magazines, supplemented by lectures. This course has been developed and enlarged, and is now offered as an elective to juniors and seniors in electrical engineering, and is chosen by about half of them. Professor Barrows described the present course and enumerated the laboratory equipment needed. In the development of this course considerable original work has been accomplished in working out constants for mathematical calculations and in other directions. These were described, with the aid of diagrams and tables, by the speaker, and his hearers approved the thorough manner in which the subject has been handled.

In the discussion Mr. Albert Scheible complimented Professor Barrows and his college on the high character of the work done in illuminating engineering, as shown by the paper. He asked if the course could be taken separately, say by architects. The answer to this was that it is the intention to give this course or a similar course to architectural students at Armour. The course will be available also for evening students. Mr. George H. Jones referred to an elementary course on this subject in the electrical engineering department of the University of Wisconsin as far back as 1896, and Professor Barrows said that he believed the University of Wisconsin, as well as Armour Institute, had a carefully worked-out course in illuminating engineering at the present time. So far as he is aware, no other technical colleges have similar courses now available for students.

The next meeting of the section will be held on June 10, at which time officers will be elected. It was decided by vote to hold this meeting at noon, as has been the case in the last two meetings, instead of in the evening.

CURRENT NEWS AND NOTES.

WIRELESS COURSE.—The Ohio State University will establish next year a regular course of instruction in wireless telegraphy and telephony.

CONVENTION OF WEST VIRGINIA INDEPENDENT TELEPHONE ASSOCIATION.—The fourth annual convention of the West Virginia Telephone Association will be held at Parkersburg, May 27 and 28. Mr. W. C. Handlan, of Wheeling, is president.

GOLD TELEGRAPH KEY.—The Washington delegation in Congress has presented to President Taft a golden telegraph key for use in opening, on June 1, the Alaska-Yukon-Pacific Exposition at Seattle. The key is adorned with gold nuggets from Alaska and has a base of Alaska marble.

NATIONAL FIRE-PROTECTION ASSOCIATION.—The thirteenth annual meeting of the National Fire-Protection Association will be held in New York City May 25-27. Among the reports to be presented will be one by Mr. C. M. Goddard as delegate of the American Institute of Electrical Engineers. Mr. Godderd will also preside at the meeting as president of the association. Mr. W. H. Merrill, of Chicago, is secretary.

GERMAN PATENTS AGREEMENT.—The patent agreement between this country and Germany, which was signed at Washington Feb. 23, has passed the second reading in the German Reichstag. In the debate on the measure it was stated that the Americans reaped the greater advantage from it, as no compulsion to work patents existed in the United States, while under the agreement Americans are released from the German compulsory clause. Whether the United States later would introduce compulsory working was, it was stated, uncertain, but the agreement presented the possibility that Germany might secure some advantage which it hitherto did not possess.

"SINGING SPARKS."—Professor Slaby and Count von Arco, of the German Telefunken Wireless Telegraph Company, have, according to a cable dispatch, perfected a new system of wireless telegraphy, which is stated to consist in sending out the vibrations which form the messages as pure musical tones, which are capable of being heard by the receiver, no matter how softly they may be attuned. It is claimed by the inventors that by means of this device it will be possible for the first time since the wireless telegraphy was established to maintain communication in spite of the most violent atmospheric disturbances. Another advantage claimed is that it will be possible to work with much smaller antennæ for the aerial wires by which the energy is absorbed. In an interview in a New York newspaper, Prof. M. I. Pupin said that the new system should also greatly increase the range of wireless telephony.

FAST GAS METERS.—Of the gas meters tested during the month of April by the New York City Public Service Commission, 50.2 per cent were found to over-register. Of the electric meters 14.1 were found too fast and 5.9 per cent too slow.

INDIANA MUNICIPAL LEAGUE.—The fourth annual meeting of the Indiana Mutual League will be held at Lafayette, June 22-24. The program prepared by Secretary J. L. McNary, of Logansport, includes a number of subjects relating to municipal lighting and kindred public service questions.

PUBLIC-UTILITY TESTING AND ACCOUNTING.—The University of Wisconsin will give a six-weeks' summer course in testing electric, gas and water service, and also a course of the same length in public-utility accounting. As the university is co-operating with the Railroad Commission of Wisconsin in its work, it has special facilities for instruction on the above subjects.

COLCHESTER PAGEANT.—For several years historical celebrations known as "pageants" have been the rage in Great Britain, the functions being organized on a large scale and frequently involving great expense for settings, costumes, etc. Among those for the present year will be one at Colchester, June 21 to 26, with 3000 performers, in which Gilbert will figure as a historical character and have his achievements narrated by the chorus.

WATER-POWER DEVELOPMENT DATA.—The U. S. Geological Survey has issued a "List of Publications of the United States Geological Survey Relating to Water Resources" which includes a number of papers relating to water-power development. These papers are available through application to the Director of the U. S. Geological Survey, Washington, D. C. If the free supply has been exhausted, they can usually be secured at a nominal price from the Superintendent of Documents, Government Printing Office.

UNLIGHTED CITY STREETS.—The city of Bucyrus, Ohio, has been in darkness for several weeks. The street-lighting contract expired on May 2 and the company refused to continue to light the streets, pending the completion of a plant by another company which secured the contract, unless the city would enter into a contract for the time desired. This the Council refused to do and the plant was closed down. Owing to the fact that the annual convention of the national body of the King's Daughters is to be held this week, the town is in an awkward position.

TELEPHONE RATES AT JAMESTOWN, N. Y.—Mayor Samuel A. Carlson, of Jamestown, N. Y., has vetoed the resolution of the Common Council of that city authorizing the Home Telephone Company, of Jamestown, to raise its rates, as announced in the issue of May 6. A two-thirds vote is required to pass a resolution over the Mayor's veto. Mayor Carlson's contention is that before the telephone rates are increased the people should first be given an opportunity to vote on the question of the purchase of the company's plant by the city for municipal operation.

WIRELESS EXPERIMENTS.—As previously noted, a series of experiments will be conducted at Brant Rock, Mass., prior to the final award of the navy contract for a wireless equipment having a radius of 3000 miles. The experiments will begin the middle of June. Brigadier General James Allen, chief signal officer of the army, and several officers of that corps will be present in the interests of the army, and Lieutenant-Commander Cleland Davis and Lieutenant George C. Sweet, of the Bureau of Equipment of the Navy, will represent the naval service. The series of experiments to be carried on will include both wireless telephone and telegraph.

JUNE MEETING ILLUMINATING ENGINEERING SOCIETY.—The next meeting of the New York Section of the Illuminating Engineering Society will be held June 10 in the Engineering Societies Building, 29 West Thirty-ninth Street. Two papers will be presented as follows: "The Evolution and Development of the Flaming-Arc Lamp," by Mr. L. J. Auerbacher; "The Illuminating Efficiencies of Various Types of Lighting Installations," by Mr. E. B. Rowe. The last-mentioned paper has been prepared particularly for installing engineers, contractors and salesmen.

INTER-DEPARTMENT BASEBALL LEAGUE IN CHICAGO.—Among the 2500 employees of the Commonwealth Edison Company, Chicago, there are enough baseball enthusiasts to afford ample material for an inter-department league. Such an organization has been formed with Mr. John W. Ferguson, assistant general contract agent, as president. Thus far six departments of the company have entered baseball teams in this league. These are the statistical, operating, treasury, contract, inspection and meter departments. Championship games will be begun on June 5, and the schedule runs to Sept. 25. Mr. George F. Long will act as press agent for the league.

TWELVE THOUSAND-VOLT TRANSMISSION IN CHICAGO.—Heretofore the standard potentials for transmission for the Commonwealth Edison Company, Chicago, have been 9000 volts to 20,000 volts, but it is planned to introduce 12,000-volt transmission, and the new Troy Street substation, to which reference was made recently in the *Electrical World*, will be a transformer substation, stepping down 12,000-volt, 60-cycle energy from the Quarry Street generating station to the standard 2300-volt potential for distribution. The 12,000-volt energy will be obtained at first by means of a 5000-kw motor generator to be installed at Quarry Street this summer, but later on generators producing 12,000-volt, 60-cycle energy direct will be installed.

NAVAL WIRELESS TELEGRAPH EXPERT WANTED—The United States Civil Service Commission will hold an examination June 9 to fill a vacancy in the position of wireless telegraph expert in the Bureau of Equipment, Navy Department. The salary is $3,000 per year. The duties of the appointee will be as follows: To have charge of the laboratory tests of all instruments and apparatus pertaining to wireless telegraphy; the standardization of circuits and instruments used in wireless; the development of special apparatus and methods of wireless signaling suited to special conditions, and of new forms of sending and receiving circuits; to inspect the various wireless stations and to make the necessary measurements of their electrical constants; to carry on quantitative experimentation and original investigation in wireless telegraphy, and, in general, to carry out such work as may be necessary for the development of the science.

A QUICK SHIFTING OF SUBSTATION EQUIPMENT.—It became necessary recently to move the entire equipment of the rotary converter for railway service which had been installed in the north end of the White City (Sixty-third Street) substation, Chicago, to the Fernwood substation on Michigan Avenue near 103d Street. The outfit consists of one 300-kw rotary, three step-down transformers, one oil switch, one complete alternating-current switchboard and one complete direct-current switchboard, the total weight being about 50,000 lb. Orders were given to the construction department to make this removal on a Thursday and shortly after midnight on Friday the equipment was loaded onto flat cars of the Chicago City Railway Company at White City and was taken to Fernwood, a distance of about eight miles by track. On the following Tuesday the machine had been installed for service and was furnishing electricity to the railway line. The operation also included the removal of several 2300-volt oil switches at the Fernwood substation to make room for the new equipment.

Divided-Fall Hydro-Electric Developments on the Hoosic River.

ONE of the most effective schemes for overcoming the inherent disadvantages of fluctuating stream flow in hydro-electric developments is to be found at Johnsonville and Schaghticoke, N. Y., where provisions have been made for storing water when it is plentiful and using it with the minimum of waste during the dry season. A reservoir six miles in length along the valley of the Hoosic River has been formed by erecting a concrete dam approximately 500 ft. in length and 40 ft. high at

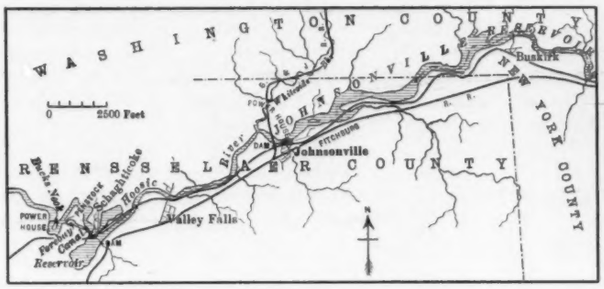


FIG. 1.—JOHNSONVILLE AND SCHAGHTICOKE HYDRO-ELECTRIC DEVELOPMENTS.

Johnsonville, about 20 miles northeast of Schenectady, N. Y. This reservoir is capable of storing an amount of water sufficient to operate 5000 hp in turbines under a 35-ft. head continously for one month during the dryest season, although the stream flow may decrease to one-half of this value. However, the 40-ft. fall in six miles of stream at Johnsonville is not the greatest on the Hoosic, because from Schaghticoke to a point about one mile down stream the fall is approximately four times as great, or sufficient to operate 20,000-hp in turbines. Moreover, the river takes a circuitous route below Schaghticoke so that the actual straight-line distance from this place to the point just mentioned is less than 2500 ft. It was found advantageous, therefore, to store the water at Johnsonville and arrange to use 5000 hp at that point and to utilize the same water in separate turbines to obtain 20,000 hp at Schaghticoke.

In order to carry out the above plans there has been constructed at Schaghticoke a concrete dam for diverting the

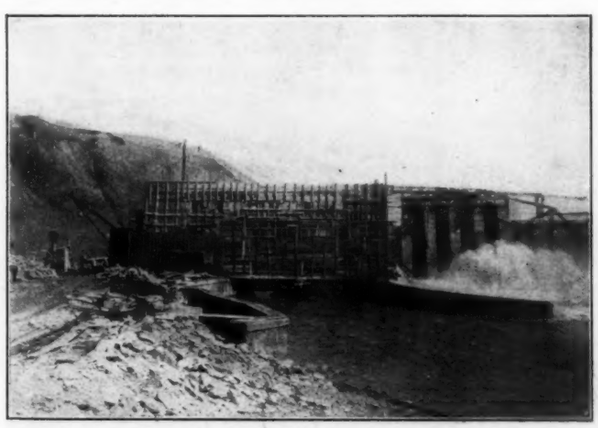


FIG. 2.—JOHNSONVILLE POWER HOUSE DURING CONSTRUCTION.

stream into a canal leading into a forebay, which feeds the water as desired into the penstock for the Schaghticoke turbines. During low-water periods the Johnsonville turbines will be run as water may be needed in the forebay, no water being allowed to escape from the storage reservoir to the lower reservoir until it has been robbed of its energy for the turbines. The relative amount of load to be carried by the Johnsonville plant will be determined by the relative depth of water in the Schaghticoke reservoirs and forebay. In any event, however, the Johnsonville plant will operate at a high efficiency because each generator can be given constant full load whenever it is in use, the fluctuation in demand being handled by the Schaghticoke generators.

A view of the Johnsonville power house and sluice gates in

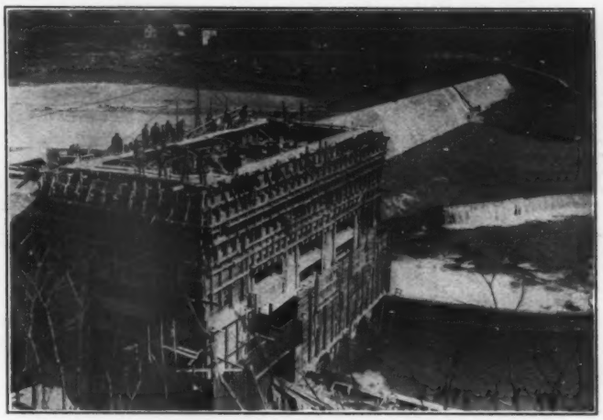


FIG. 3.—JOHNSONVILLE DAM AND POWER HOUSE NEARING COMPLETION.

the dam during construction is given in Fig. 2, while Fig. 3 shows the remaining section of the dam. The building is a single-story, concrete structure with end rooms for holding the transformers, switches and protective devices. It contains two 1800-kw alternators directly connected to 2500-hp, horizontal shaft S. Morgan Smith turbines. Each turbine is provided with two separate sets of runners and guides so arranged that the end thrust is balanced. The governors for the turbines are of the Lombard oil-actuated type, gear connected to the gate-opening mechanism. The turbines are placed external to the generator room in a concrete compartment connecting through submerged arches to the storage reservoir. Adjacent to these arches is arranged a chute in the dam, so that no trouble is expected from floating ice; the usual iron racks serve for preventing floating débris from entering the turbines.

The alternators are three-phase machines wound for 4400 volts and 40 cycles, and each is provided with a 110-volt exciter

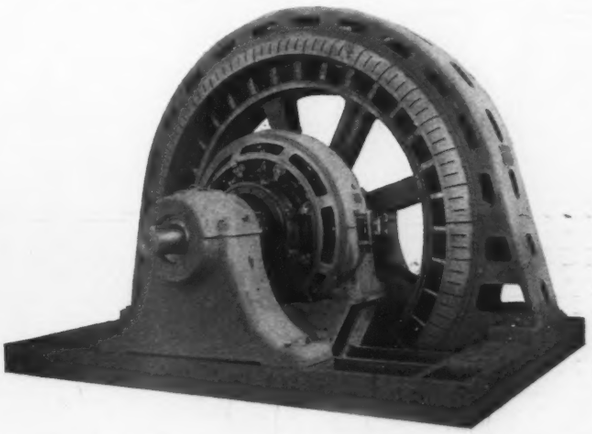


FIG. 4.—ALTERNATOR WITH SELF-CONTAINED EXCITER GENERATOR.

mounted on its shaft. Each exciter is a 60-kw interpole machine; it is capable of supplying power for the station lamps, operating the control motors and furnishing excitation for both alternators when necessary.

Each alternator is directly connected through solenoid-operated, oil-insulated switches and knife-blade disconnecting switches to the primary circuit of an 1800-kw, three-phase, water-cooled transformer. The solenoids for operating the

switches are brought into action by means of definite time-limited relays energized by series transformers. Although it is not the expectation to parallel the transformers on the primary sides, yet means are at hand for doing so if desired, on account of the fact that either generator or both may be directly connected to a local 4400-volt, three-phase circuit which will distribute energy for mill purposes in Johnsonville. The 32,000-

FIG. 5.—A VIEW SHOWING THE SCHAGHTICOKE DAM FROM BELOW.

volt leads of the transformers pass through oil switches operated by 110-volt motors governed by inverse time limited series relays. A set of 32,000-volt busbars allows the secondaries of the transformers to be parallel for connection to the outgoing line. Horn-gap lightning arresters are connected to the neutral point through three aluminum cell arresters, the neutral point being in turn joined to earth through a fourth electrolytic cell. The horn-gaps are placed on the roof of the station, leads passing through and from them by way of double-petticoated porcelain roof bushings. On account of the presence of the horn-gaps the aluminum cells are not directly connected to the lines; hence there is no continuous loss of energy in the arresters and they have no tendency to become warm. However, the films upon which the action of the arresters depends would slowly become dissipated if the cells remained disconnected, so that provision is made for short-circuiting the gaps once per day for maintaining the films in operating condition. A change-over switch allows the connections of two of the four cells to be interchanged at will in order that the film of the cell joining the neutral point and earth may be kept in proper condition.

The main transmission line from the Johnsonville station is

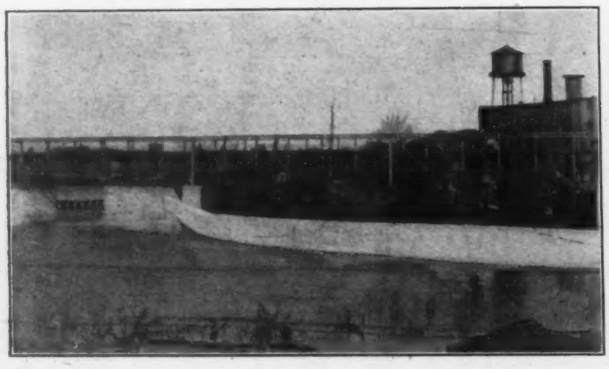


FIG. 6.—GATES FOR ADMITTING WATER TO THE FOREBAY AT SCHAGHTICOKE.

a 32,000-volt, three-phase, No. 2 copper circuit for connecting the Johnsonville transformers in parallel with the transformers at Schaghticoke. This circuit, which leaves the building through three plate-glass windows, is carried on steel lattice-work towers arranged for supporting the three wires in a horizontal plane. Each wire is held in place by means of two 25,000-volt disk insulators joined in series.

The water which passes through the Johnsonville turbines or over the dam at this place is allowed to follow the natural bed of the Hoosic River to Schaghticoke, where it enters a reservoir formed by the dam shown in Fig. 5. This dam has been given an upstream bow on account of the normal contour

FIG. 7.—UPPER SLUICEWAY IN DAM SHOWING ICE PASSING OVER DAM DURING WINTER FLOOD.

of the river bed at this point to obtain extra length of spillway. It varies in height with the irregularities of the bed, but averages about 25 ft. with a 25-ft. width of base. The down-stream side is given such a curvature as to deliver the overflow water with the least amount of vertical velocity, while the upstream side is perpendicular, as noted in Fig. 6.

At the lower end of the reservoir there are placed 10 hand-operated gates; two of these allow the reservoir to be drained when necessary, while the others admit water to the forebay.

The forebay is formed largely of earthen embankments. At the lower end, however, the concrete structure shown in Fig. 9 has been erected for admitting water into the penstock and eliminating ice and debris. The water is conveyed from the forebay to a surge tank by means of a 3/8-in. sheet-steel penstock 12.5 ft. in diameter. This penstock, which is about 900 ft. long, is supported on concrete piers with the exception of a 400-ft. section, which is on semi-circular, steel supports forming a bridge structure across the Hoosic River, as seen in Fig. 10.

FIG. 8.—LOWER SLUICEWAYS IN THE SCHAGHTICOKE DAM ON THE HOOSIC RIVER.

A view of the surge tank is given in Fig. 11. This tank, which has been placed at a point below the hydraulic level of the forebay, will permit water to rise in it without overflowing in case of an excess pressure at the turbines by a too rapid closing of the gates. From the surge tank four 6-ft. sheet-steel pen-

stocks pass to turbines for driving alternators, while one 2-ft. penstock is installed for supplying water to two exciter turbines, four water-cooled transformers and other devices in the generating station. No valve is provided at the surge tank for the 2-ft. penstock, but each of the other penstocks is equipped with a valve driven by a 250-volt, 7.5-hp motor remotely controlled in which a hydrostatic pressure of 150 lb. per square inch is maintained by means of reciprocating pumps driven by 12.5-hp, 250-volt, direct-current motors. For the purpose of synchronizing the alternators and dividing the load properly between them when they are joined in parallel, each governor is equipped with a direct-current motor for varying the fulcrum of

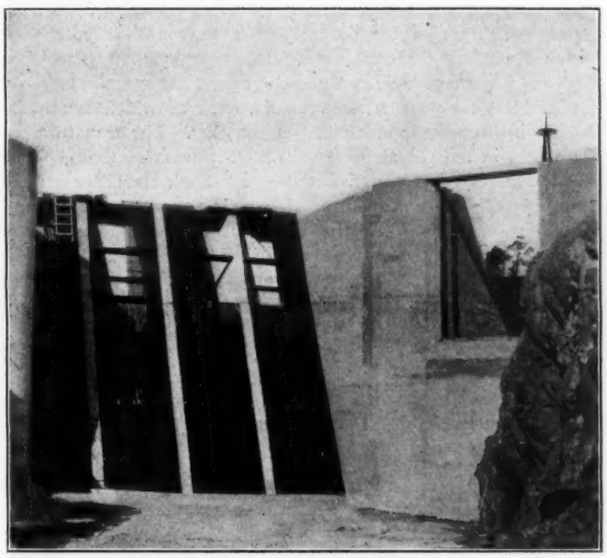


FIG. 9.—RACKS AT THE ENTRANCE TO PENSTOCK AND GATEWAY FOR DIVERTING FLOATING ICE AND DEBRIS.

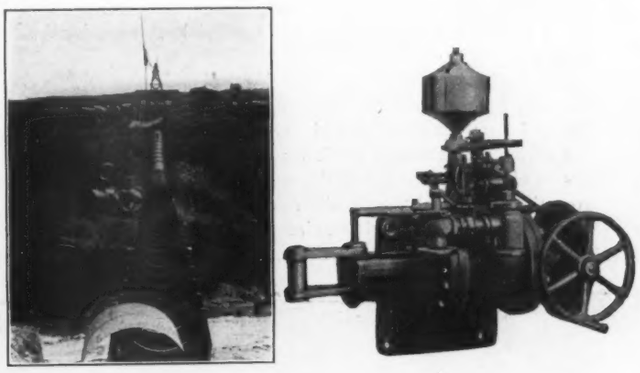


FIG. 10.—SUPPORTS FOR 12-FT. PENSTOCK ON SPAN OVER THE HOOSIC RIVER. FIG. 13.—MOTOR-CONTROLLED GOVERNOR OF WATER-WHEEL.

from the station. An indicating device in the station, employing three lamps, serves to show when each valve is open, partly open or closed.

The main turbines, of which there are four, are Pelton-Francis vertical-shaft machines rated at 5000 hp under a head of 146 ft. with a speed of 300 r.p.m. It is said that these turbines operated at an efficiency of 85 per cent when tested recently. Details of the turbine, governor and alternator are shown in the sectional elevation of Fig. 12. The turbine set is equipped with an oil-lubricated roller bearing at the top and two guide bearings along the 11-in. shaft. The oil for the

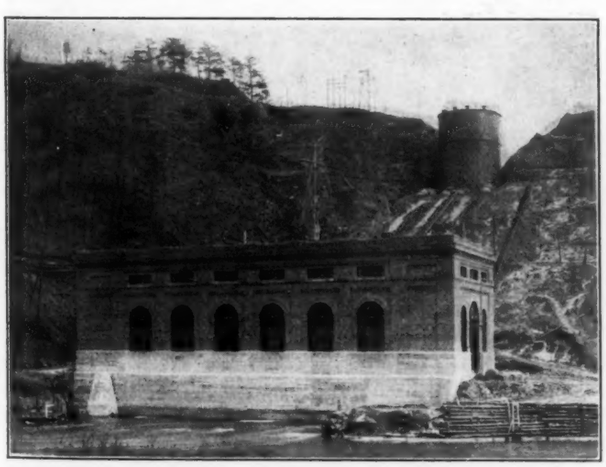


FIG. 11.—SURGE TANK, PENSTOCKS, GENERATING STATION AND TRANSMISSION LINES.

bearings is circulated by means of a belt-driven pump which furnishes oil to the upper roller bearing from which it flows by gravity to the guide bearings.

The speed of each turbine is regulated by an oil-actuated Pelton governor rated at 15,000 ft.-lb. Oil for the governors is taken from two storage tanks provided with air cushions

the lever of the centrifugal mechanism which determines the speed at which the oil valves will be opened or closed. The governor motors are controlled remotely from the switchboard gallery which overlooks the generator-room. Fig 13 gives a

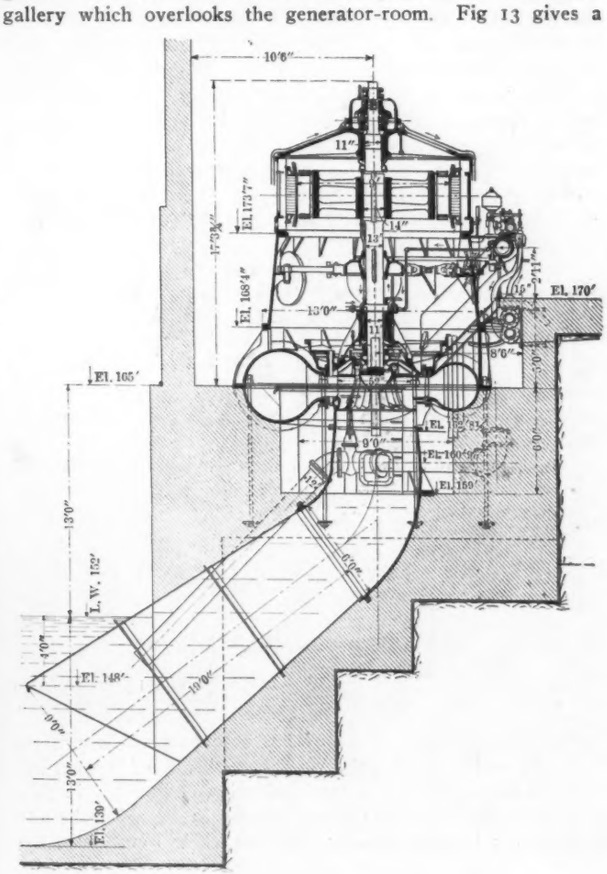


FIG. 12.—CROSS-SECTIONAL ELEVATION THROUGH TURBINE AND GENERATOR.

view of the governor mechanism, which can be adjusted by hand when desired. The oil under pressure is admitted to one end or the other of a cylinder, the position of the piston in which regulates the opening of the gates admitting water to the turbine runner.

As will be seen from Figs. 12 and 14, the alternators are of

the revolving field type. Each is a 3000-kw, three-phase machine designed for 4400 volts. Being built with 16 poles, it delivers 40-cycle current when running at 300 r.p.m. The combined efficiency of the turbine and generator at full load is about 82 per cent.

The three 4400-volt leads from each generator are laid in fiber conduits which convey them through series transformers, solenoid-operated oil switches, and disconnecting switches to a set of 4400-volt busbars, which are equipped with sectionalizing switches.

The leads, oil switches, operating solenoids, disconnecting switches, busbars and sectionalizing switches are located immediately below the switchboard gallery, as indicated in Fig. 15. The series transformers work through definite time-limited relays to close the circuits of the solenoids, which receive energy from the station's 250-volt, direct-current circuits.

From the 4400-volt busbars, circuits pass through four 3000-kw transformers for increasing the e.m.f. to 30,000 volts, which is impressed upon a second set of busbars arranged in a room above the switchboard gallery. The scheme of connection shown in single, instead of triple, circuit is illustrated in Fig. 17. The 4400-volt feeders supply energy in Schaghticoke for operating the DuPont Powder Mill, the Cable Flax Mills, the Empire Grist Mill, and for village lamps, including 40 40-cp, 12-volt, 4-amp, constant-current series tungsten street lighting units. Moreover, energy is supplied at 110 volts through two 50-kw, single-phase transformers for the station lamps, which include carbon-incandescent lamps and six carbon-arc lamps. In addition to the circuits shown in Fig. 17, an incoming 32,000-volt circuit receives energy from the generators at Johnsonville.

Only low-tension circuits pass to the switchboard, although all of the station circuits are represented on the board by means of leads from series and shunt instrument transformers. The wiring of the board is well illustrated in Fig. 16, which shows also the field rheostats for the exciter generators.

The exciter generators are 150-kw, 250-volt, interpole, direct-current machines, provided with commutators held in place by shrink rings. Each generator is driven at 600 r.p.m. by a 250-hp horizontal-shaft, Pelton-Francis turbine. The direct-current generators supply energy not only for the field circuits of the generators, but also for the various control motors connected with the station, for certain emergency station lamps, and for a 20-ton Alliance Machine Company crane.

There are four main transformers, each of which is an oil-insulated, three-phase unit rated at 3000 kw. The transformers are placed in individual fireproof compartments separated from the generator-room by iron doors. Each transformer is equipped with three 1.25-in. cooling coils through which water flows continuously from the exciter-turbine penstock. Provision is made for removing the oil rapidly from the transformer through a 6-in. pipe into a special tank when desired. Moreover, the transformers are placed on wheels so that they can be drawn into the generator-room under the crane when repairs become necessary.

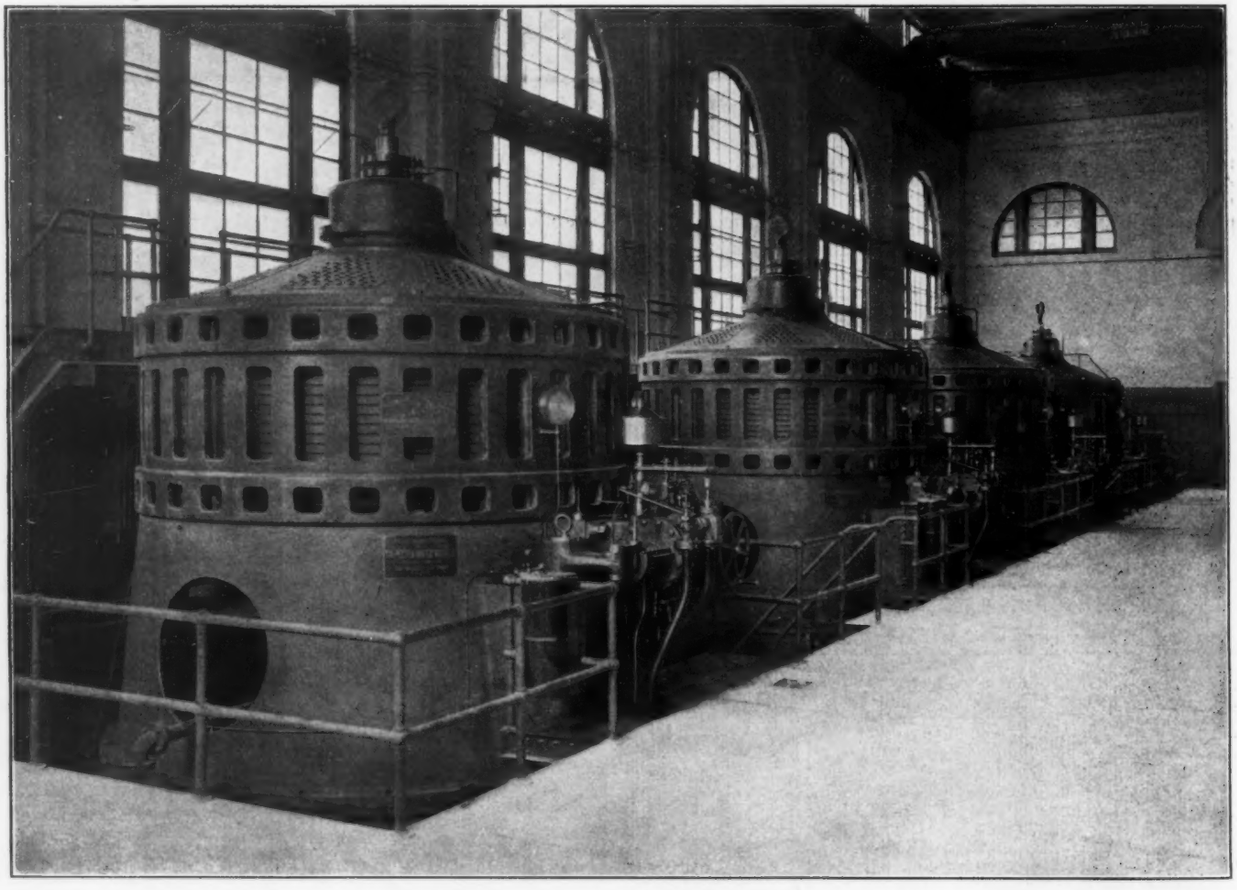


FIG. 14.—GENERAL VIEW OF ALTERNATORS.

The arrangement of the lightning arresters and outgoing circuits from the building is similar to that used at Johnsonville, except that the main leads pass upward through the roof by way of porcelain bushings rather than through the side wall. The six bushings, three horn-gaps and three disk-strain insulators for one of the three three-phase, 32,000-volt lines are illustrated in Fig. 18. As noted previously, one circuit connects with the Johnsonville station; the other two form No. 3-0 copper cable transmission lines for delivering energy to a substation at the works of the General Electric Company, at Schenectady, 18 miles distant. The two three-phase circuits

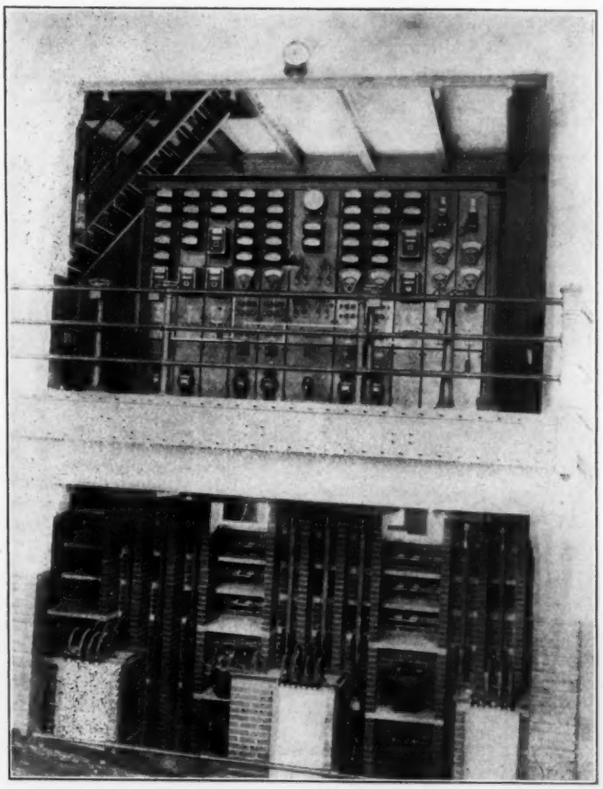


FIG. 15.—SWITCHBOARD AND 4400-VOLT CIRCUITS IN SCHAGHTICOKE STATION.

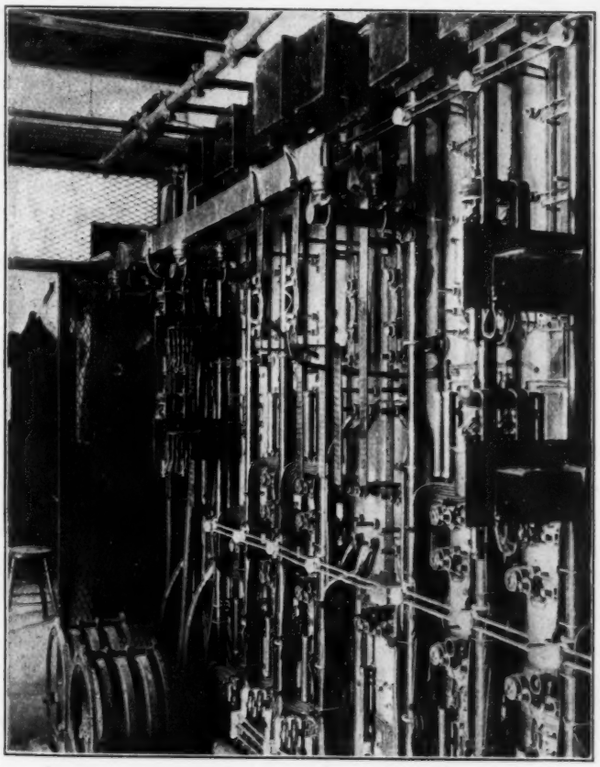


FIG. 16.—REAR OF SCHAGHTICOKE SWITCHBOARD.

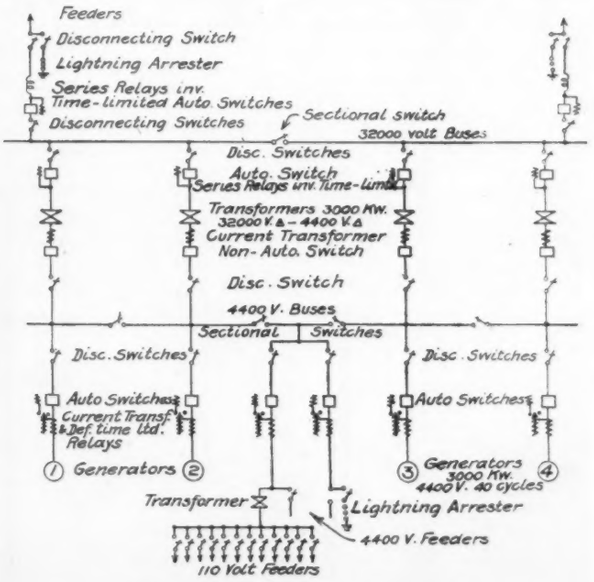


FIG. 17.—DIAGRAM OF CONNECTIONS.

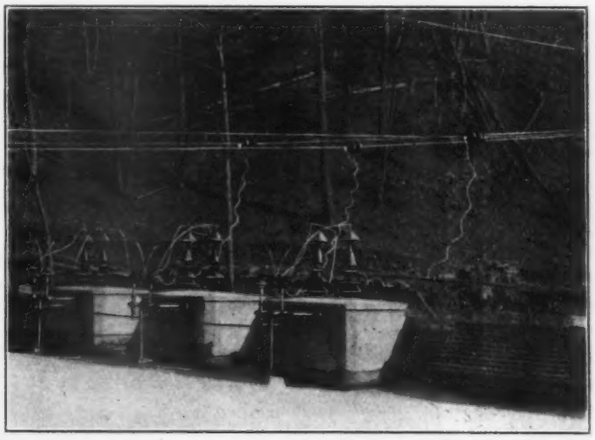


FIG. 18.—ONE OF THE LINES LEAVING SCHAGHTICOKE STATION SHOWING HORN-GAP ARRESTERS.

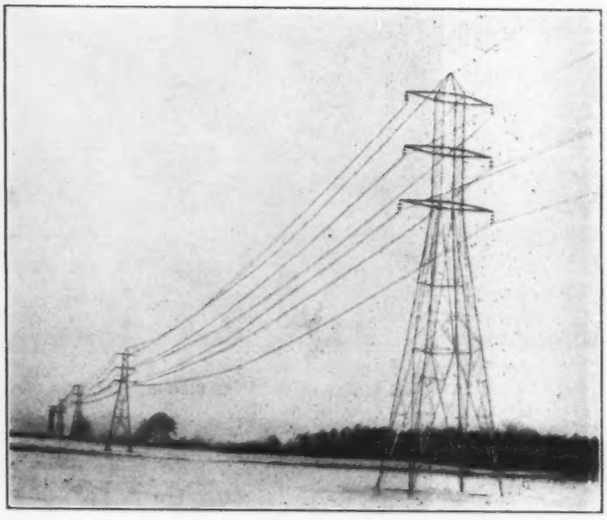


FIG. 19.—GENERAL VIEW ALONG TRANSMISSION LINE.

DIVIDED-FALL HYDRO-ELECTRIC DEVELOPMENTS ON THE HOOSIC RIVER.

are carried on a single line of steel towers, although for the first span leaving the building twin poles were provided, as shown in Fig. 11. This span is dead-ended against six anchor poles located on the hillside at the rear of the station, the disks shown in Fig. 18 serving as strain insulators in this span. The six wires are here arranged in a horizontal plan, while along the remainder of the pole line they are placed in two vertical planes—one for each three-phase circuit—as shown in Fig. 19. Of the 197 towers between the generating station and the substation, 12 are for partial-transposition (Fig. 20), and 6 are transposition towers (Fig. 21). At each transposition point the wires are given one-third of a turn helically, so that there are two total turns throughout the route. The straight-line towers are 51 ft. in height to the lowest cross-arm, the cross-arms being separated by 10 ft. Each tower is extended above the upper cross-arm for supporting a 3/8-in. steel cable used as a grounded wire for protection from lightning. The individual circuits are separated by about 17 ft. and are held in place by two porcelain disk suspension insulators similar to those used on the Johnsonville line.

Where the natural surroundings will permit, the towers are given a 600-ft. spacing; however, spans twice this length were necessary when crossing the Hudson River near Schaghticoke and Sanders Lake near Schenectady. Three special towers 96 ft. in height were required near Schenectady, while the standard 76-ft. towers were suitable for the span across the Hudson. Additional special heavy towers were required at points where the line changed direction abruptly. As shown in Fig. 22, the angle towers are substantially braced, while the wires are held in place by duplicate sets of strain insulators.

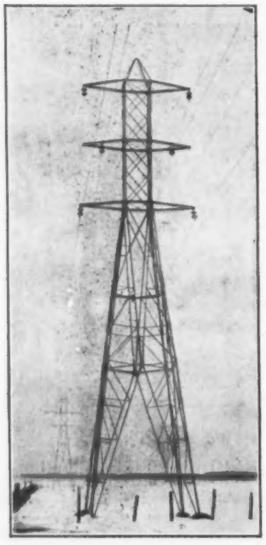


FIG. 20.—PARTIAL TRANSPOSITION.

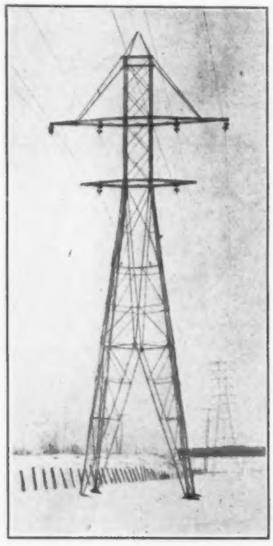


FIG. 21.—TRANSPOSITION TOWER.

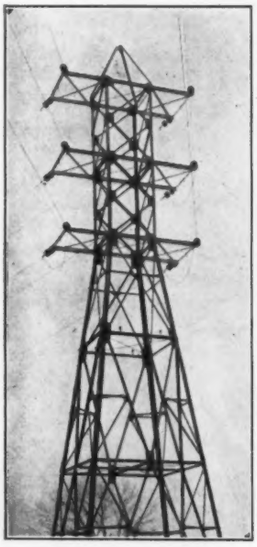


FIG. 22.—ANGLE TOWER, WITH STRAIN INSULATORS.

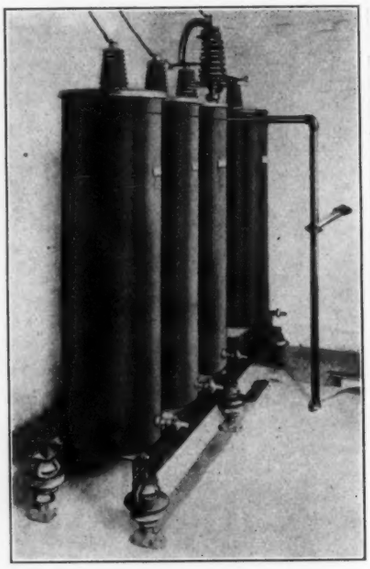


FIG. 24.—ALUMINUM-CELL ARRESTER WITH CHANGE-OVER SWITCH

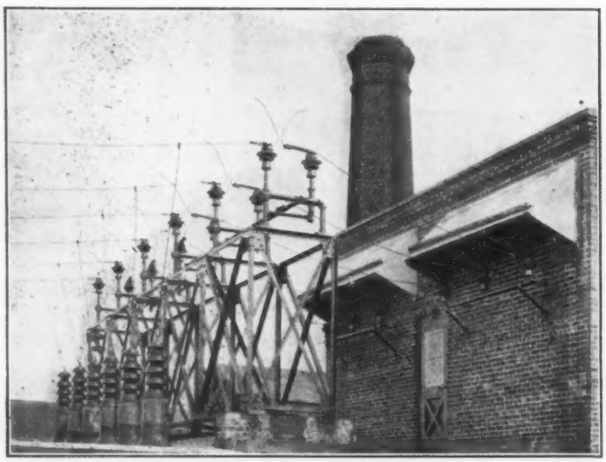


FIG. 23.—DUPLICATE THREE-PHASE CIRCUITS ENTERING SUBSTATION AT SCHENECTADY.

At each railroad crossing an uninsulated angle-iron bar, with upturned ends, is placed below each pair of wires so that any broken wire will be "grounded" before it can cause danger to life.

Two No. 6 galvanized-iron wires transposed at every tower have been erected for telephone service. To eliminate all danger from the high-tension wires, the telephones are connected to the iron wires by means of insulating transformers.

At the Schenectady substation the six transmission lines enter the building through petticoated porcelain roof bushings, as shown in Fig. 23. In shunt to these circuits are two three-phase lightning-arrester equipments arranged with horn-gaps and aluminum cells similar to those used at Johnsonville and Schaghticoke. The horn-gaps with short-circuiting mechanism are illustrated in Fig. 22, while the aluminum cells with change-over switch for charging the fourth cell—as explained previously—is shown in Fig. 24. With the exception of the grounded wire along the whole line the aluminum cells are the only lightning protective devices used in conjunction with the circuits.

An unusual feature of the above equipment is the frequency, namely, 40 cycles. This value was chosen in order that the new equipment can be paralleled with the older equipment receiving energy from a steam plant at Schenectady and a water plant at Spiers Falls and Mechanicville these three plans furnish energy for the General Electric Company, the Schenectady Illuminating Company and for operating the Schenectady railways. This value of frequency is preferable to 60 cycles for rotary converters and better than 25 cycles for general illumination.

The above-described hydro-electric equipments are owned by the Schenectady Power Company, of Hoosic Falls, the officers of which are: President, George E. Greene, Hoosic Falls; vice-president and general manager, Howard W. Starr, Schenectady; secretary and treasurer, H. R. Leyden, Troy; manager, E. B. Doen, Schaghticoke. The consulting engineers were Messrs. Viele, Blackwell & Buck, New York. The electrical equipment was supplied by the General Electric Company, while the transmission line towers were built by Milliken Brothers, of New York.

A Graphical Study of Self-Induction.

BY F. P. MCDERMOTT, JR.

THE transient phenomena occurring in circuits containing self-inductance are usually studied by means of differential equations. In this article, however, a certain type of problem is treated graphically. The method employed enables curves to be plotted quickly, and may be understood without a knowledge of calculus.

The type of problem here discussed is defined by the conditions that only one inductive resistance occurs in the combination of circuits studied, that this possesses a self-inductance which is independent of the current through it, and that it is possible to express the relation by the equation $e = p\,(I - i)$, where

e = the e.m.f. of self-induction at any instant.
i = the current at the same instant,
p = a constant, depending on the resistances, and
I = a constant depending on the resistances and the applied e.m.f.

In addition to the above notation, the following is used:
E = the e.m.f. applied to the circuit, or combination of circuits,
L = the self-inductance,
R = the resistance.
a = the rate of rise of current.
t = time.
$k = p \div L$.

The prime and double prime symbols are used where the circuit is divided, in order to indicate to which branch a quantity belongs.

The subscripts 0, 1, 2, etc., are used to connect other quantities with the various values of i, that is, when $i = i_0$ $t = t_0$, etc.

The units used are volts, amperes, ohms, henrys, seconds and amperes per second. The curves are plotted according to the usual practice, in which the X axis represents time, and the Y axis, current. From the definition of the henry

$$e = aL \qquad (1)$$

When the current is rising, a is positive and, therefore, equation (1) as written, gives e a positive value for rising current; when the current is rising, e has that direction which opposes the current. The positive direction of e is therefore defined as that direction which opposes the current. In the problems here discussed $e = p\,(I - i)$. Equating this with the value of e given in (1), dividing by L and substituting $k = p \div L$,

$$a = k\,(I - i) \qquad (2)$$

To construct the time-current curve, having given the values of I and k, and the initial value i_0 of the current, proceed as

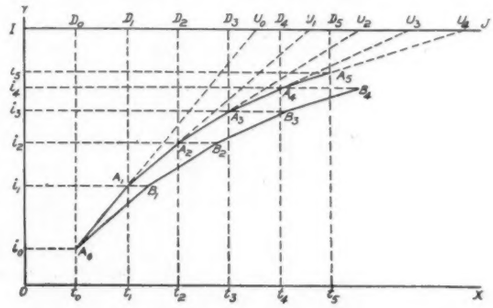


FIG. 1.—EARLY AND LATE CURVES OF CURRENT INCREASE.

follows: Draw the co-ordinate axes OX and OY, Fig. 1. Select a suitable current scale and draw the indefinite horizontal line IJ, at a height representing I amp. If some definite value of t, say t_0, has been assigned to the time at which i has the value i_0, locate the point A_0 in the position corresponding to these values. The scale for i was determined when IJ was drawn, but the scale for t must also be settled before locating this point unless $t_0 = 0$. Generally no particular value of t_0 is found, in which case it is convenient to let i_0 occur at the time $t = 0$. A_0 may then be located without previously determining the scale of time. Draw the ordinate t_0 (which coincides with the Y axis when $t_0 = 0$), passing through A_0 and meeting IJ at D_0. From equation (2) it is seen that the current rises at the rate of $k\,(I - i_0)$ amp per second when i has the value i_0. That is, $I - i_0$ amp in $\frac{1}{k}$ seconds. Locate U_0 on the line IJ, to the right of D_0, so that $D_0U_0 = \frac{1}{k}$ seconds. If the time scale has not previously been determined, a scale should now be selected which will give U_0 a convenient location. Join A_0 and U_0. The line A_0U_0 represents a rise of $I - i_0$ amp in $\frac{1}{k}$ seconds, which is the rate at which the current is rising when it has the value i_0. Since i_0 and t_0 do not enter in the expression $\frac{1}{k}$, giving the length D_0U_0, it follows that the corresponding line for any other value of i has the same length. This fact is the basis of the construction here employed. Assume that A_0U_0 represents with sufficient accuracy the time-current curve until after the instant t_1. Draw the ordinate t_1 meeting A_0U_0 in A_1 and IJ in D_1. Locate U_1 on the line IJ, to the right of D_1, so that $D_1U_1 = D_0U_0$. Draw A_1U_1. Then A_1U_1 represents the rate at which the current increases when it has the value i_1. Assume that this represents the time-current curve with sufficient accuracy until after the instant t_2. Draw the ordinate t_2, thereby locating the point A_2, and proceed in a similar manner to find the points A_3, A_4, etc. Then A, A_1, A_2, A_3, etc., is the time-current curve required.

There is an error in this construction which may be made as small as desired by taking the instants t_0, t_1, t_2, etc., sufficiently close to one another. These instants are here selected so as to make the diagram easily understood, but at the sacrifice of accuracy. The possible magnitude of the error may easily be determined. The point A_1 is located by assuming that the current changes from the value i_0 to the value i_1 at the rate represented by the slope of the line A_0U_0. In reality the current changes at this rate only when it has the value i_0 and at a slower rate thereafter. The line A_0U_0 therefore represents the current as reaching values subsequent to i_0 earlier than it actually does. Even if the point A_1 were correctly located, A_1U_1 would represent the current as reaching values subsequent to i_1 too soon. As A_1 represents the value i_1 reached too soon, so much the more does A_1U_1 represent the current as reaching its various values too soon. Similarly the whole curve, with the exception of the starting point A_0, represents the current as attaining its different values too soon. Draw A_0B_1 parallel to A_1U_1, meeting the horizontal line $i = i_1$ at B_1. Draw B_1B_2 parallel to A_2U_2, meeting the horizontal line $i = i_2$ at B_2. Similarly locate the points B_3, B_4, etc. A_0B_1 represents the current as changing from i_0 to i_1 at the rate at which it changes when it has the value i_1. This is the slowest rate of change that it has at any time in passing from i_0 to i_1, and therefore A_0B_1 represents the current as reaching the values subsequent to i_0 too late. Similar reasoning applied to the remainder of the curve, $B_1B_2B_3$, etc., shows that all portions of it, with the exception of the point A_0, represent the current as reaching its various values too late. The two curves here described may be called the "early" and the "late" curves respectively. The true curve lies between the two. If a point be plotted midway between A_3 and B_3, for example, this point represents the time at which the current reaches the value i_3, with an error not exceeding $\frac{1}{2}A_3B_3$. The application of the method will now be illustrated by a few problems.

Problem 1.—A battery having an e.m.f. of 10 volts is connected to a coil of 20 ohms resistance and 1 henry self-inductance. Plot the curve showing the values of the current immediately after the battery is connected.

The excess of the battery electromotive-force E over that consumed by resistance is consumed by self-induction. That is, $e = E - iR$, or, in this case, $e = 10 - 20i = 20\,(0.5 - i)$. This equation, therefore, possesses the form $e = p\,(I - i)$ as

required by the second condition. $p=20$ and $I=0.5$. But $\frac{p}{L}=\frac{20}{1}=k$. The conditions of the problem can thus be reduced to the form of equation (2), by writing $a=20\,(0.5-i)$. At the instant that the battery is connected the current is zero,

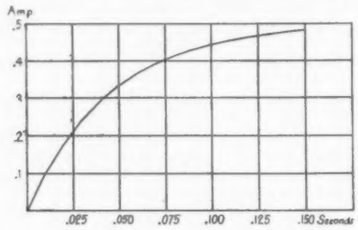


FIG. 2.—EARLY BUILDING-UP CURVE.

and this instant is also taken as the zero of time. With this information the curve is plotted. Fig. 2 shows the "early" curve.

Problem 2.—After the current has reached its steady value, in the arrangement described in problem 1, an additional resistance of 10 ohms is inserted without opening the circuit. Plot the time-current curve showing the effect.

At the insertion of the additional resistance $i=\frac{10}{20}=0.5$ amp. As in the previous problem, $e=E-iR$. After the insertion of the additional resistance, the total resistance of the circuit is 30 ohms. Therefore $e=10-30\,i=30\,(0.333-i)$. Here $p=30$, $I=0.333$. $k=\frac{p}{L}=\frac{30}{1}=30$. For the zero of time take the instant at which the additional resistance is introduced. A portion of both the "early" and the "late" curves are shown in Fig. 3. In this case e is negative, and the current is decreasing.

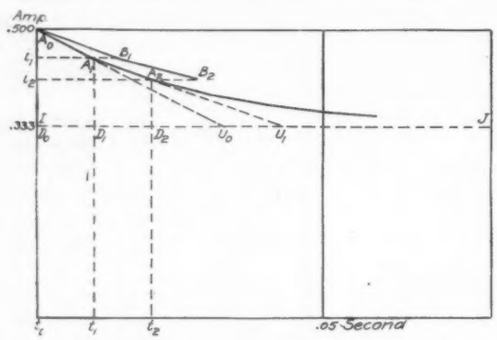


FIG. 3.—REDUCTION CURRENT TIME CURVES.

As this makes the construction slightly different from that previously described, a few of the construction lines are given. The points are lettered to correspond with Fig. 1.

Problem 3.—With the scheme of connections shown in Fig. 4, determine the currents i, i', i'', in the various branches immediately after the battery is connected to the circuit.

The electromotive force between Y and Z is that of the battery, less the drop in XY. This value must be further reduced by the resistance drop in the inductive branch in order to obtain the value of e.

$$e=50-5\,i-10\,i'' \qquad (3)$$

By inspection of Fig. 4,

$$5\,i+20\,i'=50 \qquad (4)$$

$$i=i'+i'' \qquad (5)$$

Eliminating i from (3) and (5),

$$e=50-5\,i'-15\,i'' \qquad (6)$$

Eliminating i from (4) and (5),

$$i'=2-0.2\,i'' \qquad (7)$$

Eliminating i' from (6) and (7),

$$e=40-14\,i''=14\,(2.86-i'') \qquad (8)$$

Since i'' is the current whose change produces e, the value of e is obtained in the required form, where $p=14$, $I''=2.86$. $k=\frac{p}{L}=\frac{14}{0.35}=40$. At the instant of the connection of the battery to the circuit, i'' is zero and this instant is taken as zero of time. The curve i'', Fig. 5, is the "early" curve, plotted ac-

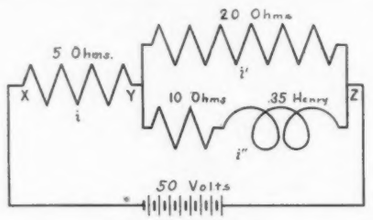


FIG. 4.—INTERCONNECTED CIRCUITS.

cording to the data here given. Having obtained the i'' curve, the others may be plotted from it. The construction of a few of the points on these curves is given in detail. The i' curve is plotted by the use of equation (7). Draw a horizontal line representing 2 amp. At the time $t=0$, $i''=0$, and $i'=2$. The point A_0' is plotted accordingly. On the ordinate t_1 locate a point A_1' lower than the 2-amp line by a distance equal to $0.2\,i_1''$. A construction for obtaining the various values of $0.2\,i''$ is shown in the illustration. $QP=0.2\,RP$, P being located at any convenient point on the horizontal axis. $A_1''M_1$ is a horizon-

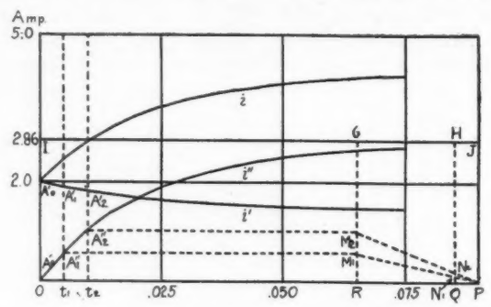


FIG. 5.—CURRENT INCREASE IN INTERCONNECTED CIRCUITS.

tal line, meeting the ordinate RG in M_1. N_1 is the point where the line M_1P meets the ordinate QH. Then $QN_1=\frac{QP}{RP}\,RM_1=0.2\,RM_1=0.2\,i_1''$. A_1' is therefore located a distance QN_1 below the 2-amp line. Similarly, other points on the i' curve are located, and the curve is drawn through these points. To obtain the curve for i, make use of equation (5). Add together the values of i' and i'' at a given instant to get the value of i at that instant, and plot the point accordingly. When sufficient points have been obtained, draw the curve through them.

Measuring Small Currents of High Frequency.

Mr. Riccardo Arno read a paper recently before the International Society of Electricians in Paris on an instrument for measuring telephone currents and in general periodic currents of high frequency and very feeble intensity. The instrument contains a magnetic system with a vertical axle subject to the action of two rotary fields, equal but revolving in opposite directions. A coil coaxial with the magnetic system carries the current to be measured. "The action of this coil changes the hysteresis lag the more the greater the intensity and the frequency of the current, within certain limits. There results a variation of the hysteresis of the magnetic system and one gets a deflection." The rotary fields are in general produced by two sets of coils, one in series with an ohmic resistance and the others with a self-inductance or capacity. A movable coil for each field permits bringing the instrument to the zero point.

The Switchboard Equipment of the Indiana Steel Company at Gary, Ind.

BY E. A. LOF.

IN a previous article the main interconnections of the electrical equipment of the Indiana Steel Company, at Gary, Ind., were described. The present article deals with the storage-battery installation and the details of the switchboard equipment.

STORAGE BATTERY.

One of the main features of the Gary installation is the large storage-battery installation which is provided for the purpose of minimizing the fluctuations of the load on the generating station. This installation consists of two separate batteries connected in parallel. Each battery consists of 125 cells, 73 plates per cell, and has a rating of 4320 amp with a momentary rating of from two to three times that amount. The batteries are installed in a two-story building located directly north of the power house; the connections between the battery house and the power house are run through a tunnel.

The alternating-current regulation is accomplished by means of two 2000-kw, split-pole rotary converters. The collector-ring side of each of these converters is connected to a set of step-down transformers, the high-tension side of which connects through two electrically operated oil switches to the main alternating-current busbars. The oil switches are of the automatic type, provided with overload and inverse-time-limit relays. Each control panel is equipped with three ammeters, one voltmeter, a three-phase indicating wattmeter and the necessary control switches, indicating lamps and synchronizing plugs and receptacles.

The positive lead on the direct-current side of each converter is connected to two single-pole, motor-operated, carbon-break circuit-breakers, one being the starting breaker and the other being the running breaker; the former is rated at 1500 amp and the latter at 10,000 amp. The positive lead, after passing through these breakers, by means of a set of double-throw and single-throw switches are connected to the storage battery or to the main direct-current positive busbar.

The negative lead runs to the automatic starter which consists of six 1500-amp contactors with magnetic blow-outs, one 10,000-amp toggle-joint magnetic blow-out type contactor and the necessary relays. The positive lead connects to the 12,000-amp automatic overload battery circuit-breaker and thence through knife switches to each set of the storage battery.

To start the rotary converter, the 1500-amp starting breaker is first closed. Then the circuits to the first of the six contactors of the starter are closed, after which the remaining contactors of this size close automatically in succession, the rapidity of the closing being governed by the series relay. The closure of the last contactor completes the circuit of the 10,000-amp toggle-type contactor and closes it. This contactor, in turn, short-circuits the starting contactors and at the same time opens the control circuit to their windings thereby causing them to drop out. The converter is then synchronized with the busbars and the oil switch is closed. Each oil switch is provided with a contact switch which, when closing the oil switch, will complete the control circuit through the low-voltage coil on the direct-current starting circuit-breaker and trip it. The voltage of the converter is then adjusted and the running breaker is closed. This circuit-breaker is designed to open automatically on overload, and to open if the converter should attain a dangerously high speed, or if the voltage should decrease to too low a value. The opening of the oil circuit-breaker on the high-tension side will also cause the breaker to be tripped.

All of these breakers and the starters are controlled by switches on the benchboard, the control switches for the running breaker and the starters being mechanically interlocked in such a way that the running breaker can not be closed when the starter is open; furthermore, it is necessary to trip the running breaker before the starter can be opened. In addition, provision is made that when the toggle-type starting contactor opens it completes the circuit through the tripping coil of the running circuit-breaker.

As before stated, the rotary converter is of the split-pole type. It has two distinct and separate field windings and cores The main field is excited from the main exciter busbars in the usual way and its field-circuit leads are connected through a double-pole, solenoid-operated field-circuit discharge switch, the field-circuit rheostat being of the motor-operated cross-head type.

The regulating or auxiliary field winding of the rotary obtains its current from a synchronous motor-driven special synchronous converter. The current for this converter is supplied from a series transformer in each leg of the generator leads. Through three-pole Pallet switches on the generator oil switches, the regulating transformer leads for each generator are connected to regulator transformer buses, one set being provided for each of the main alternating-current busbars. The transformer buses are, in turn, connected through regulator transformer bus-selector switches and through regulator transformer series-paralleling switches to three totalizing auto-transformers. These transformers are finally connected to the six slip-rings of the synchronous converter, while from the commutator is taken the regulating current for the auxiliary field of the rotary. A three-pole switch, which is operated automatically, is provided for short-circuiting the totalizing transformers when the running circuit-breaker of the converter opens.

The pallet switches on the generator oil switches are so arranged that the regulating transformers of each generator are short-circuited when that particular generator is not in service. Connections are also made through two switches so that when stations No. 2 and No. 3 are tied together the battery will regulate on both. Should, however, either tie switch be opened for disconnecting the two stations, no regulation is possible on station No. 2 and all of the series transformers in the generator leads of that station are at the same time short-circuited. All the regulating transformer switches are of the magnetic blow-out type controlled from the benchboard.

The synchronous motor for driving the synchronous-converter is started by means of an auto-transformer starter, which is connected to the low-tension side of either set of the rotary-converter transformers by means of remotely controlled throw-over switches. The potential starter, which is also remotely controlled, consists of three sets of three contactors in connection with three auto-transformers.

To start the motor the operator throws pilot switch No. 1 to position No. 1, thus energizing two sets of the contactors. One set of the contactors will connect the three auto-transformers across the line and the other set will connect the motor to intermediate taps on the auto-transformers. This position will give the motor a suitable e.m.f. for starting and accelerating. The operator holds the pilot switch in the starting position while the motor is accelerating. When the motor has been brought up sufficiently close to synchronous speed, or possibly to synchronous speed, he throws pilot switch No. 1 to position No. 2, thus disconnecting the auto-transformers by means of the two sets of contactors noted above and connecting the motor directly across the line by means of the third set of contactors.

To stop the motor use is made of a second control switch, No. 2, which, when thrown to one side or the other, will operate the holding coils of the last set of contactors, thus opening these contactors and stopping the motor.

As noted previously, two control switches are provided, one for starting and the other for stopping the motor. The first two sets of contactors, which control the starting position of the motor, are not equipped with holding coils and it is necessary for the operator to hold these switches in the closed position while the motor is accelerating. The three sets of contactors which connect the motor directly to the line are equipped with holding coils, so arranged that these switches will remain in closed position without taking current, but the holding coils must be energized to open the switches. Auxiliary con-

tacts are provided for operating pilot lamps on the benchboard.

The field circuit of the synchronous motor receives energy from the main exciter buses; a double-pole, solenoid-operated field-circuit switch and an electrically operated field-circuit rheostat are provided.

In the positive lead of the converter is installed a left-and-right reading 20,000-amp ammeter operated from a minerallac shunt, and for the battery there are provided two recording wattmeters, one left-and-right reading ammeter and one recording voltmeter.

The direct-current regulation of the battery is accomplished by means of two 2000-amp, 60-volt boosters. The motors and generators of these booster sets are of the interpole type, the field coils of the generator receiving energy from a separate motor-driven exciter, the field circuit of which is connected through a carbon regulator to the positive direct-current totalizing feeder busbar.

The positive side of both the booster generator and the booster motor of each set is protected with single-pole circuit-breakers closed independently and so arranged that whether closed from the benchboard or at the circuit-breaker switchboard by hand, the generator breaker cannot be closed before the motor circuit-breaker, nor can it be kept closed when the motor circuit-breaker is open. For this reason the generator and motor circuit breakers are both electrically and mechanically interlocked. The negative leads of the booster generators are provided with knife switches and are connected to the negative converter and battery busbar. In the negative

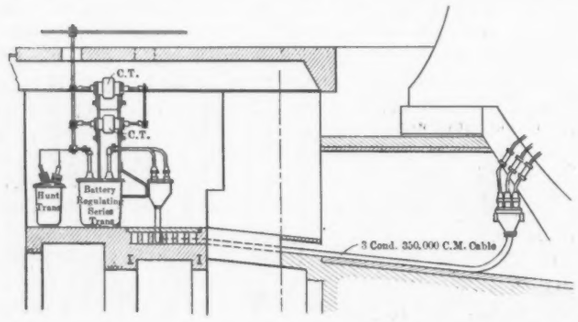


FIG. 1.—SUPPORTING TABLE FOR ALTERNATING-CURRENT GENERATOR CABLES.

booster-motor lead is installed an automatic contactor-type starter, which is also controlled from the benchboard; the connections are so made that the generator circuit-breaker cannot be closed when the motor breaker is closed and the starter is open, in order to prevent the booster generator from taking energy from the busbars and running as a motor. In addition to the overload coils, each breaker is provided with low-voltage coils connected to the speed-limiting device on the booster. The generator circuit-breaker is of 2000 amp rating and the motor circuit-breaker is rated at 500 amp.

Each booster generator is equipped with manually operated field-circuit rheostat and a double-throw field-circuit switch for making connections to either the main excitation bus or to the motor-generator exciter. The motor of this exciter set is connected to the main busbars through a double-pole circuit-breaker and an automatic starter, and the field circuit of the exciter is also connected to the main busbars through a double-column carbon regulator and is provided with the necessary rheostats and field-circuit switches.

Each booster panel is provided with two ammeters and the exciter with an ammeter and a voltmeter. All control switches and indicating lamps for the various circuit-breakers and starters in connection with the booster equipment are located on the benchboards, the circuit-breakers, switches and starters being placed on panels close to the machines.

GENERATOR LEADS.

The leads connecting the alternating-current generators with the oil switches in the busbar structure consist of 350,000-circ. mil, three-conductor, lead-covered, paper-insulated cable. For the support of this cable there is provided in the basement a concrete table running the total length of the station and close to the general foundations. By referring to Fig. 1 it will be

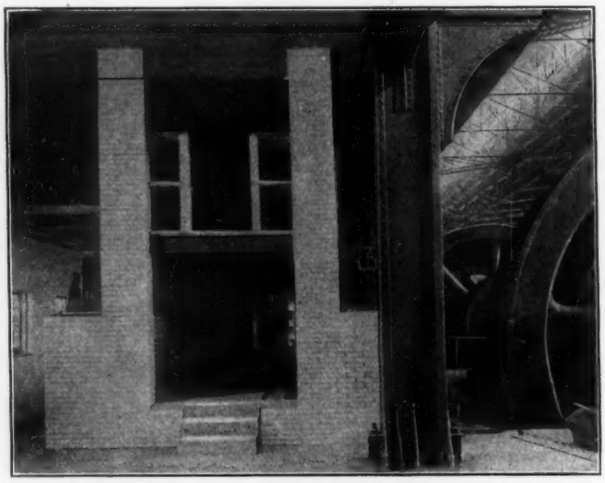


FIG. 2.—GENERATOR OIL SWITCH AND BUSBAR STRUCTURES.

seen that this table is provided with grooves, one for each cable. Potheads, filled with minerallac compound, are provided where the cable is connected to the generators as well as where the cable is connected to the copper bars in the busbar structure. Underneath the cable table are brackets supporting the field-excitation busbars, while on the side of the table supporting columns are provided for the support of the field-circuit rheostats and switches.

The leads for the direct-current generators and the exciters consist of bare copper bars of ¼-in. thickness by from 3 in. to 6 in. wide, the bars being separated by means of ¼-in. spacers and supported on iron hangers and insulated with slate slabs.

BUSBAR STRUCTURE.

The busbar structure is of the so called "double-deck" construction with the generator switches located on the main floor

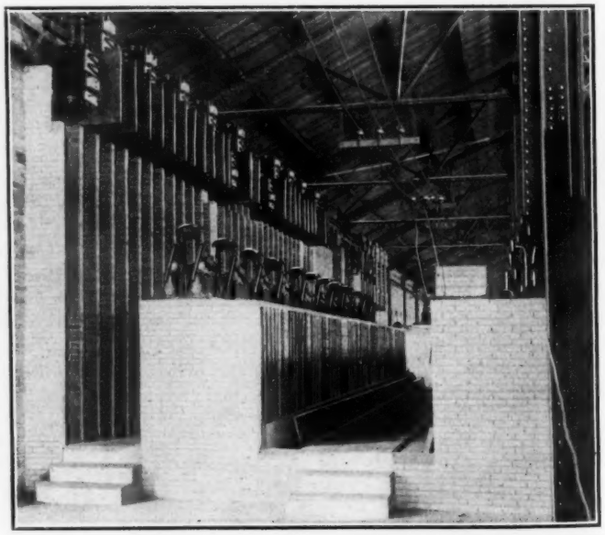


FIG. 3.—ALTERNATING-CURRENT FEEDER OIL SWITCH STRUCTURES.

and the feeder switches directly above on the gallery. Fig. 2 shows the lower tier comprising the generator oil-switches and the two sets of alternating-current busbars. Fig. 3 shows the upper tier with the feeder oil switches, the out-going feeders and the lightning arresters.

By referring to Fig. 2 it will be seen that the generator switches are arranged in two rows with one switch in each row for each generator, the switches connecting the generators to either the left or right set of the busbars. The feeder

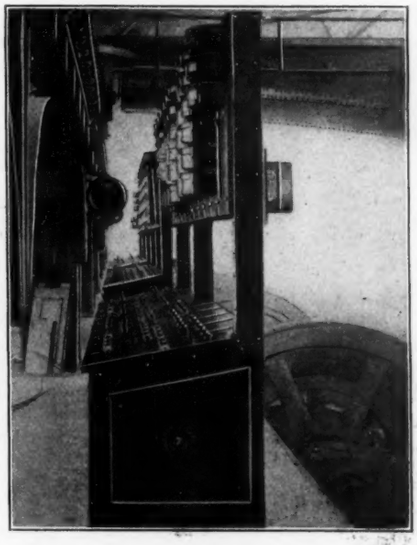


FIG. 4.—CONTROL BENCHBOARDS FOR STATION NO. 3.

switches are located correspondingly, so as to connect the outgoing feeder circuits to either the left or right busbars.

The structure is built of brick and supported by a very substantial iron skeleton work. All exposed surfaces are lined with white-enameled brick. All leads and busbars are separated by brick barriers, and walks are provided through the structure.

The direct-current busbars consist of laminated bars insulated by means of slate slabs and supported on iron hangers.

BENCHBOARDS.

All of the switching devices mentioned above are electrically

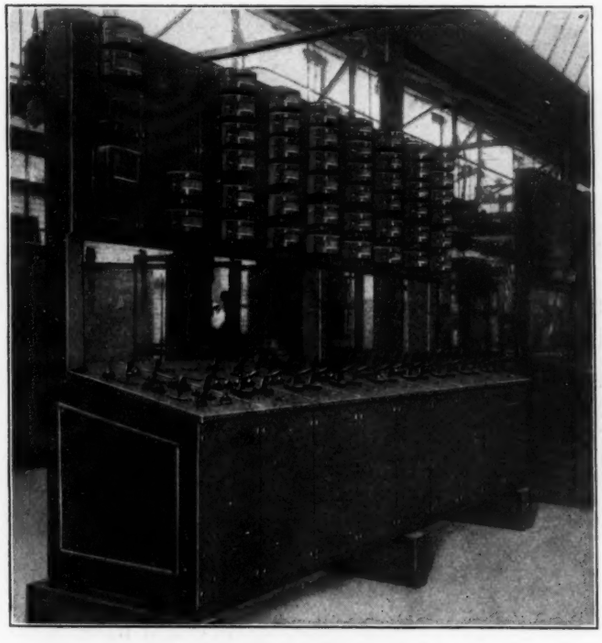


FIG. 5.—GENERATOR CONTROL BENCHBOARD.

operated and controlled from benchboards located on the gallery so as to allow the operators an uninterrupted view of the stations. In order to facilitate the operation they are suitably divided into several sections.

The benchboards consist of a very substantial frame construction with slate panels upon which are mounted the instruments, the control switches and the indicating lamps. The sides and rear of the board consist of sheet-steel sections, which can easily be removed in order to get an easy access to the interior of the boards. Between the instrument panels and the control switch panel there is a large open space which gives the operator a clear view of the station. Fig. 4 shows the three benchboard sections for station No. 3 as they are installed, while Figs. 5 and 6 show one of the benchboard sections on the construction floor. Fig. 6, which gives a good view of the interior of the benchboard, shows that each section is provided with test panels on which terminate the instrument wiring as well as all the control wiring from the various switches, instruments and transformers in the various parts of the station. These test panels are very easily accessible by removing the rear sheet-steel doors, and they afford means for testing each individual circuit without opening it. All of the instruments are of the horizontal-edgewise pattern with a dull-black finish. The direct-current instruments are of the permanent-magnet type and the alternating-current instruments are of the dynamometer type.

For the illumination of the benchboards there is provided a continuous reflector mounted in front of the boards and extending along the full length of each section.

RELAY BOARDS.

Separate relay boards are provided, upon which are mounted all the reverse-current and overload-time-limit relays. One re-

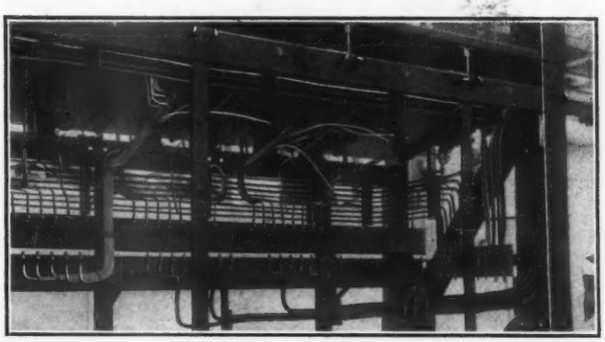


FIG. 6.—INTERIOR OF CONTROL BENCHBOARD, UNDER CONSTRUCTION.

verse-current relay is furnished for each set of generator oil switches; these relays energize special relay switches, which in turn close the tripping circuit of the oil switches. For each set of the feeder oil switches, one double-pole, overload and inverse-time-limit relay is furnished. These relays operate directly on the tripping coils of the oil switches.

DIRECT-CURRENT GENERATOR AND EXCITER SWITCHBOARDS.

Fig. 7 shows a view of the generator switchboard for one of the direct-current generators and also the heavy direct-current busbars, which are supported on hangers under the gallery. One switchboard is furnished for each of the two direct-current generators; it is located on the main floor in front of the machine which it protects. By referring to the illustration it will be seen that the board is built in two parts, each separated from the other. The part to the left consists of two panels on which are mounted the negative generator circuit-breaker and one watt-hour meter. The right-hand part of the board, which faces the generators, consists also of two panels on which are mounted the positive and equalizer circuit-breakers. By so dividing the direct-current switchboards that the negative devices are on entirely separate panels from the positive apparatus the danger of short-circuits is considerably diminished.

The direct-current generator and storage-battery busbars and connections are clearly shown in Fig. 7; the enormous size of these can be imagined when it is known that nearly 100,000 lb. of copper is used in them.

The three exciter switchboards are located separately in front of the respective exciters and are of the same construction

as the direct-current generator boards. All boards are of Monson Maine oil-finished slate, and the framework is of a very heavy, self-supporting construction.

DIRECT-CURRENT FEEDER SWITCHBOARD.

This switchboard is located on the gallery immediately above the direct-current generator boards. Like these, it is constructed in two separate sections, one for the negative apparatus and one for the positive. In Fig. 8 is shown the positive side, on which is mounted the knife switches and watt-hour meters, while Fig. 9 shows the negative side with the negative, motor-operated circuit-breakers. The positive side also contains one panel for the carbon device for the storage-battery regulation. The direct-current feeder circuits consist of bare copper bars which pass through ducts in the building wall and are insulated by slate panels. On the outside of the building is provided a bracket upon which is mounted heavy insulators for supporting and anchoring the copper bars.

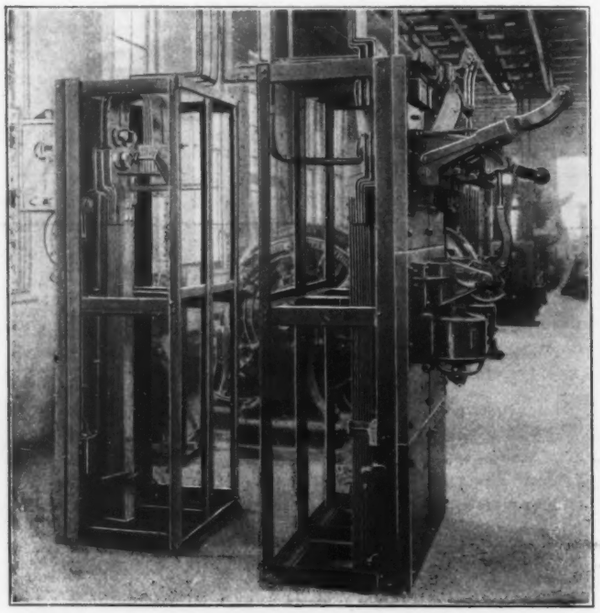


FIG. 7.—DIRECT-CURRENT GENERATOR SWITCHBOARD.

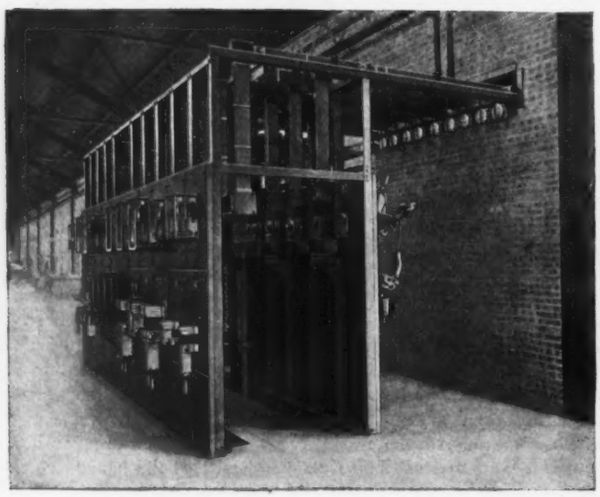


FIG. 8.—POSITIVE DIRECT-CURRENT FEEDER SWITCHBOARD.

STORAGE-BATTERY SWITCHBOARD.

This board consists of several panels and, like the other direct-current boards, is divided into two parts. It contains all of the circuit-breakers, switches, etc., for the control of the storage battery, the synchronous converters, the boosters and various auxiliary machines in connection with the storage-battery regulations. The panels consist of slate supported on heavy framework. The heavy copper connections are supported on heavy brackets on the rear and run from there through the basement to the synchronous converters and the battery house. Fig. 10 shows a view of this switchboard.

OIL SWITCHES.

All of the generator oil switches are of the non-automatic type and the feeder switches are of the automatic. They are three-pole, double-break, part of them being operated by means of electromagnets and some by means of motors. All of the live metal parts are immersed in oil, of which only a relatively small amount is required. Provision is made for easily removing the oil tanks for repairs and inspection.

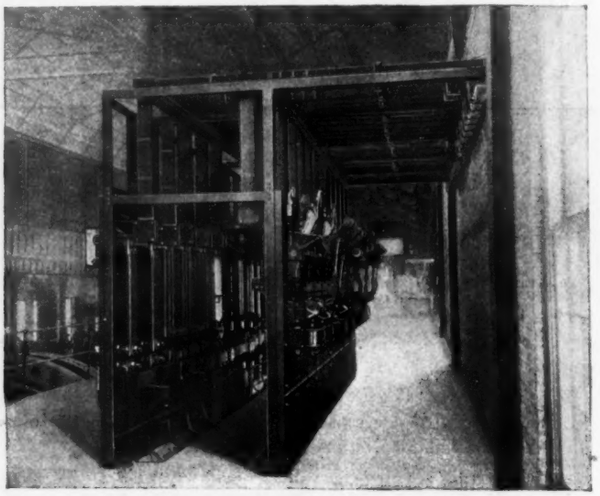


FIG. 9.—NEGATIVE DIRECT-CURRENT FEEDER SWITCHBOARD.

The switches are erected in a masonry structure with each pole of the switch and the oil tank in which it is immersed in a separate fireproof compartment. There are two breaks in series for each pole of the switch, each break being in a separate compartment.

Energy for the electromagnets and motors for closing and tripping the switches is obtained from the exciters, direct-current generators or storage battery. In case of failure of the operating circuit, the switches can easily be operated by hand without in any way disturbing the mechanism.

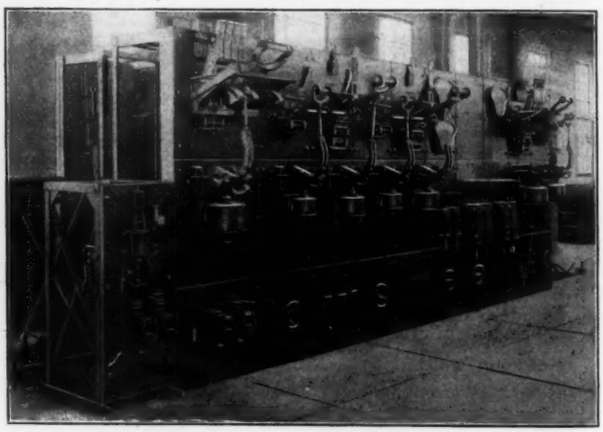


FIG. 10.—STORAGE BATTERY, ROTARY AND BOOSTER SWITCHBOARD.

The construction of the oil switches is such that the entire switch is set in place and lined up before the oil tanks are placed in position, with the contacts exposed to view so that they can be accurately adjusted. All sediment formed in the

oil settles at the bottom of the tanks, leaving the oil clear about the contacts. The oil level is readily determined by means of a small sight gage. When necessary, the tank can easily be drained and refilled when in position. The tanks themselves, which are made of sheet steel, are thoroughly insulated from the circuit and all live metal parts are placed inside of it under oil, so that no high-tension parts are exposed in the compartments. Mounted on each oil-break switch is a small double-

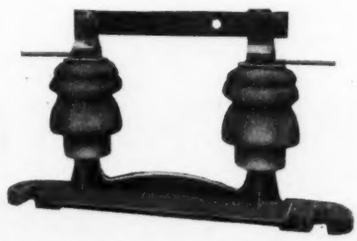


FIG. 11.—6600-VOLT DISCONNECTING SWITCH.

pole, double-throw pallet switch of the knife-blade type. This switch is operated by the motion of the levers of the oil switch and is used for the indicating and tripping circuits.

CIRCUIT-BREAKERS AND SWITCHES.

The direct-current generators, the direct-current side of the rotary converters, the battery, the boosters, the synchronous motor-exciter sets, the induction motor-exciter sets, the tie boards and the direct-current feeder circuits are protected with motor-operated carbon-break laminated circuit-breakers controlled from the benchboard, the open or closed position of the breaker being shown by red and green indicating lamps.

When the control switch is thrown to the closing position, the motor is put in circuit and a magnet is energized. This magnet forces a worm on the end of the motor-shaft into mesh with a worm-gear which is connected by means of a rod to the closing-arm of the circuit-breaker, at the same time cutting out the control switch at the benchboard, and thereby connecting the motor directly on the control bus. The breaker is fully closed in about three-fifths of a second, at which time the position of the laminated contact operates another switch, which opens the motor and magnet circuits, thus throwing the worm out of mesh and at the same time putting the control switch into circuit ready to open the circuit-breaker, which action again throws the motor switch into the closing position. The operator at the benchboard cannot close the circuit-breakers against overload, nor is there means for equipment control from the time the motor is started until the breaker is fully closed.

These circuit-breakers are of standard design, very substantially built, having only six millivolts drop from contact to contact at the rated current of the circuit-breaker; two millivolts being lost in the laminated contact bridge and two millivolts at each contact. The knife switches which are used in ratings up to 10,000 amp are of the multi-blade rear-connected type, having an extra-fine "draw-file" finish.

The disconnecting switch used on the 6600-volt, alternating-current system in connection with the oil switches are of a very substantial construction, as shown in Fig. 11. It will be seen that the base consists of an iron casting, with two cast-iron pins, upon which are cemented two high-tension insulators. Upon these insulators in turn are cemented cast-iron caps to which the switch jaws are bolted. By using this construction, the switches will always remain in alignment and can easily be mounted on the wall or at any other place. All switch parts are well finished and liberally designed.

STARTING SWITCHES.

All of the motor starters are of the multiple-contactor type, including the necessary cast-iron-grid resistors, and all contactors are provided with magnetic blow-outs. The starters, which are controlled from the benchboard, are provided with independent opening and closing coils. These coils are not energized after the first starting switch has been closed, so that a failure of the supply voltage will not open the starting switch. The first starting switch is energized by the closing of the control switch on the benchboard, and the first starting switch in turn energizes the next contactor, the closing of which in turn energizes and closes the next, and so on until the last one cuts out the last section of the resistor. The rapidity of this closure is governed by a series relay, and the closing of the last contactor short-circuits the other contactors and at the same time opens the circuit to their windings, thereby causing them to drop out. One side of the opening and closing coil is connected to one side of the control bus and the other side of the coils is connected to the above-mentioned control switch. The last contactor of the starters is provided with small contact switches which closes a circuit to the indicating lamps on the benchboard which show the open or closed position of the starter.

LIGHTNING ARRESTERS.

Each 6600-volt, alternating-current feeder-circuit and tie-line is provided with one three-phase multi-gap lightning-arrester. These arresters consist of a series of spark gaps shunted by a graded resistance but without a series resistor.

Ample space is provided between the different phase leads, which are separated from each other by means of fireproof barriers. Each arrester can be separated from the line by disconnecting switches. Fig. 12 shows the lightning arrester equipment for the 22,000-volt line to South Chicago Works.

Besides the above lightning arresters, there is provided for each set of 6600-volt busbars a three-phase lightning arrester of the electrolytic type. This lightning arrester consists of three columns of aluminum trays supported by a porcelain rod and separated by means of porcelain washers. These trays, which are connected between the line and the ground, contain a liquid electrolyte, the evaporation of which is prevented by

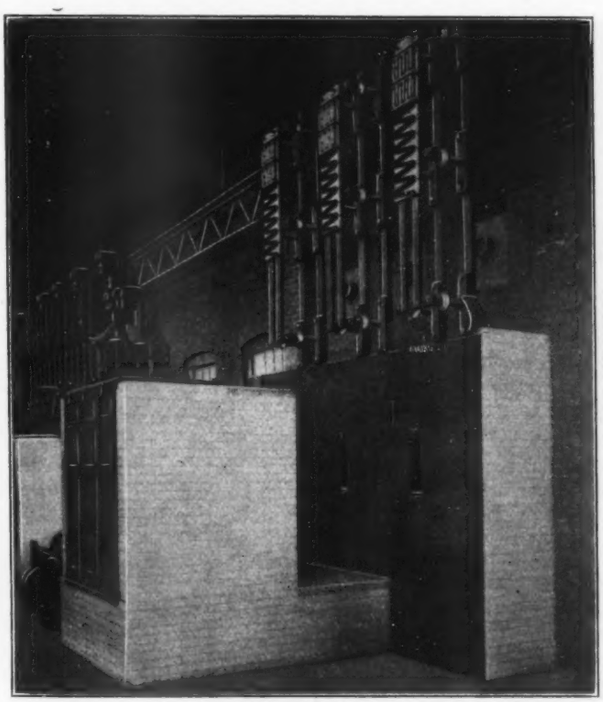


FIG. 12.—22,000-VOLT LIGHTNING ARRESTER EQUIPMENT.

a film of oil on its surface. The columns are set in stone jars filled with oil.

When a current passes from the trays to the electrolyte there is formed on the trays a film which has the desirable characteristics of preventing the flow of current at normal voltages and of breaking down with abnormal voltages to such an extent that it practically forms a short circuit; then, upon cessation of normal potential, the film regains its resistance.

The direct-current feeder circuits are protected with single spark-gap arresters in which the discharge spreads itself over a block along a number of minute discharge paths.

CONTROL WIRING.

All control wiring between the benchboards and the oil switches, circuit-breakers, starters, instrument transformers, etc., consist of double-braid rubber-covered wires of sizes ranging from No. 6 to No. 12 B. & S., no smaller size being used. All of the wires are installed in electroduct conduit, which is laid in the gallery and engine-room floors and also in the basement. All joints in these conduits are well reamed to avoid possibility of destroying the insulation of the wire, and several connection boxes are installed where the continuous runs would have been too long.

STATION LIGHTING.

For lighting the two stations about 400 incandescent lamps and 100 arc lamps are installed, the incandescent lamps being distributed on the switchboard gallery, around the engines and generators and in the basement. The arc lamps are suspended on the roof trusses and on brackets fastened to the building columns and on the building walls.

Energy for the incandescent lamps is taken from the 6600-volt system. For the arc lamps, however, energy is obtained from the 250-volt, direct-current system. All of the arc lamps are provided with inner globes and white enameled metal shades.

The above-described switchboard equipment was designed and built by the Western Electric Company, of Chicago.

Non-Attendance Electrical Plant at Westfield, Mass.

There has been in successful operation for about six years at Westfield, Mass., a novel hydro-electric installation of small capacity which is of interest on account of its almost automatic character. No attendance is required in this plant, with the exception of about half an hour's work at night and another half-hour's visit in the morning for oiling and cleaning. The plant is owned by John C. Buschmann, proprietor of the Bismarck Hotel, and a prominent tobacco dealer and real estate owner of the community. It supplies electricity to the above-

FIG. 1.—EXTERIOR OF NON-ATTENDANCE PLANT.

mentioned hotel, to a tobacco warehouse, and also to the proprietor's residence adjoining. All the current used in these places is employed in lighting service at about 225 volts. The installation is a direct-current one throughout. There is no auxiliary city service connected.

The plant is located about three-eighths of a mile north of the Bismarck Hotel, which is situated close by the Westfield station of the Boston & Albany Railroad. The proprietor owns a pondage of approximately 20 acres lying immediately behind the station, and which receives the flow of Powder Mill and Timber Swamp brooks. The power house is located at the base of an earth dam about 200 ft. in total length, with a spillway of stone masonry about 50 ft. wide. There are no other water-power developments on this water privilege. The dam gives a head of 22 ft. on the single water-wheel which the station contains, and at no time has it been necessary to use flash boards.

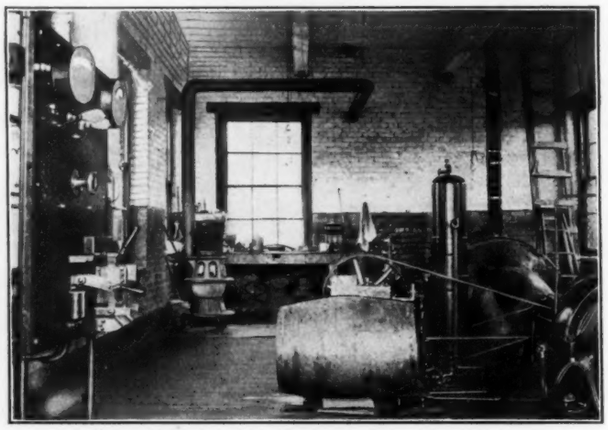


FIG. 2.—TURBINE-ROOM.

The pond is employed in winter for ice cutting for the use of the hotel, but no difficulty has ever been experienced with the ice in relation to the continuous operation of the machinery.

A small gate house is installed at a bulkhead at the top of the dam above the power station, controlling the flow of water through a steel-riveted penstock 42 in. in diameter and ⅜ in. thick. This penstock is 40 ft. long, and it delivers water to the wheel without change in direction. The power-station building is a brick structure of one story, 32 ft. long and 20 ft. wide, with masonry foundations. The generating machinery consists of an 18-in. McCormick horizontal turbine made by J. & W. Jolly, of Holyoke, Mass., direct-connected on a horizontal shaft through a coupling with a 150-amp, 250-volt, compound-wound, direct-current generator built by the E. G. Bernard Company, of Troy, N. Y. This unit is mounted in a masonry foundation, and the normal capacity of the turbine is 56 hp, the speed being 300 r.p.m. The wheel-case is covered with an insulation re-

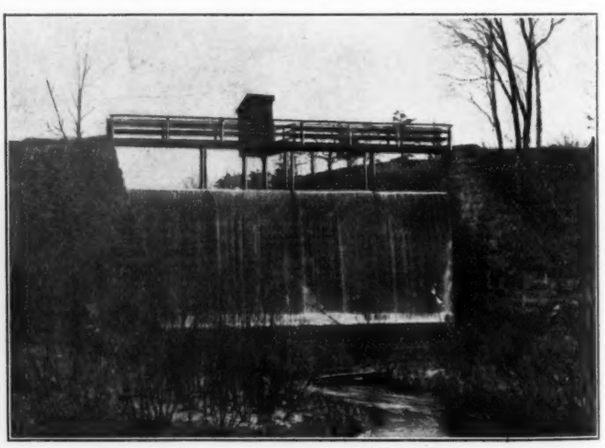


FIG. 3.—DAM AND SPILLWAY.

sembling asbestos, to prevent condensation from the atmosphere, and the case is fitted with a ¾-in. pipe tap for drinking and washing purposes. A 14-ft. draft tube extends from the bottom of the turbine case to the tailrace of the plant, which leads ultimately into Westfield River. The tailrace is about 50 ft. long, and discharges into the spillway below the dam. It is of masonry, 8 ft. deep and 9 ft. wide.

The turbine is controlled automatically by a Lombard gov-

ernor, which is direct-connected to the wheel, and adjusted to a point where it will respond to the turning on or off of one 16-cp incandescent lamp in the station. A special cone receptacle has been installed on the stem of the governor valve to collect oil and prevent dripping or spreading over the floor. There are three bearings on the generating unit, and each is equipped with a thermostat alarm which rings a bell in the hotel office in case a bearing becomes overheated. Another gong is located in the station for the same purpose. When a bearing becomes overheated, the plant can be immediately shut down by an electric switch controlling the governor, the switch being located at the hotel. A battery of 12 cells of the liquid type is used for the thermostatic and shut-off connections.

The wiring in the station is all carried overhead through the generating-room to a switchboard consisting of a marble panel containing a voltmeter and ammeter, a field rheostat, a circuit-breaker, and a double-pole, single-throw knife switch, for cutting the generator in and off the line. The panel is 48 in. high by 36 in. wide, and from this the outgoing line is run to the hotel. The line consists of two parallel circuits of No. 4-0 conductors in multiple, or four wires in all, carried on chestnut poles spaced 75 ft. apart and varying in height from 25 ft. to 30 ft. Two galvanized-iron wires are installed on the pole line for the operation of the thermostat circuit, and there are also two similar wires installed for a private telephone line between the hotel and the station. The switchboard and wiring were installed by the Berkshire Electric Company, of Pittsfield, Mass., as were the bells and thermostats. The turbine room is lighted by four 16-cp incandescents. The average loss on the line is about 4 volts. The present connected load amounts to about 350 lamps of 16 cp. Current is distributed from the hotel office as a center, a 36-in. x 30-in. panel having been installed at this point. On it are mounted an ammeter and a voltmeter, which are duplicates of those at the generating station, together with appropriate enclosed fuses and knife switches from which branch lines run about the premises.

This plant has frequently run for 6 to 12 weeks at a time without stopping, and with only casual attention for a short while each day. The man who looks after it is employed about the premises of the hotel on non-technical work most of the time, and is not an engineer or electrician. When the plant was installed the work was done under the supervision of Mr. J. Fred Buschmann. Messrs. Rivers and Young, of Holyoke, renovated the water-power by raising the level of the old dam 4 ft., installing new aprons, building the power house, lowering the wheel pit, and constructing the tailrace walls. Mr. Buschmann has a general oversight of the operation of the plant at present. The total cost of the installation was about $10,000, including the hydraulic work, station equipment and line.

Guard Wires on Transmission Lines.

By Max H. Collbohm.

The desired main function of a grounded guard wire over a transmission line is to protect the power wires from direct lightning strokes, and to discharge the latter to ground with the least inductive and other effects upon the system. To attain these results a study of the characteristics of atmospheric lightning must be made as far as possible in order to judge the probable behavior of guard wires of different materials, form and arrangement.

The researches of Dr. C. P. Steinmetz indicate that the current of a single stroke of atmospheric lightning is of the order of 10,000 amp and has a frequency of 500,000 cycles per second and over. These figures seem to illustrate that a good protection against direct lightning strokes cannot very well be expected from practically any guard wire installation used up to the present, as will be explained later on.

The conditions affecting the amount of protection afforded by a guard wire are its inductance and its specific ohmic resistance. The first named causes the well-known skin, or self-inductive, effect, whereby at very high frequencies current density in the outer shell is increased and the middle is practically unused.

There appears to exist a widespread misconception that in case of high-frequency currents only the surface of a conductor is believed to influence the conductance of it without regard to the specific ohmic resistance of the material at all. This is obviously wrong, as there is certainly a definite radial distance over which the current density varies from 100 per cent on the very rim down to, say, 1 per cent further inward. The difference between outside and inside radius, or the width of such an annular ring (in case of a solid round wire) may be very small with high-frequency currents, but it still represents a definite part of the cross-section of the wire. It follows therefore that the specific resistance, particularly that of the very rim of the ring, is of great importance, and the more so the smaller this effective ring is.

The width of this effective ring is not only dependent upon the frequency of the current, but also, to a very great extent, inversely upon the magnetic permeability of the conductor. Therefore the effective cross-section in an iron wire must be very much smaller than in a non-magnetic wire. Moreover, the specific ohmic resistance of iron being very high (about seven times greater than copper) it follows that the effective resistance of an iron wire offered to a heavy high-frequency current is enormous, and the more so the greater the distance between adjacent grounds. It would seem surprising therefore that iron guard wires have not proved protective on some systems, for it can easily be imagined that the equivalent spark-gap of such a protective system under a direct lightning stroke may be greater than that of the ionized air at the place of lightning between the guard wire and power wires and between the latter and the steel-tower structure.

In connection herewith the writer desires to call attention to a dangerous method of protecting ground wires by placing them inside an iron pipe, when entering the ground. This arrangement certainly introduces a very high inductive resistance and offers a constant source of danger to adjacent structures.

As a rule, iron guard wires are galvanized and the thin coat of zinc will be quite effective as a non-magnetic shell of comparative low specific resistance. However, galvanizing lasts only for a few years, after which the effective resistance of the iron wire alone determines the amount of protection afforded.

A great improvement over a single solid iron wire can be had by using a number of smaller iron wires stranded into a cable. By this arrangement the resistance to the magnetic flux pulsating around the cable is very much increased, and consequently the inductive resistance of the cable proportionally diminished. However, this improvement does not appear great enough in case of a direct lightning stroke with its enormous amount of current as to give an iron cable a protective quality anywhere near such of a non-magnetic cable. It has, moreover, the disadvantage of a short life on account of corrosion assisted by the accumulation of moisture in the interstices of the cable.

On account of the foregoing it seems evident that only non-magnetic conductors, or those magnetic conductors having a comparatively large non-corrosive and non-magnetic outer shell (copper-clad steel wire), would be likely to offer sufficient protection. As a solid conductor is subject to considerable increase in resistance by skin effect, it would be of advantage to build the conductor in form of cables, or flat ribbons, or eventually tubing if it can be properly supported, as, for instance, in power stations. The latter forms are generally recommended by manufacturers for connecting their lightning arresters to ground.

As the ohmic and inductive resistance of a conductor is proportional to its length to the ground, it follows that grounding on every pole, if this can be accomplished, would give the best protection obtainable. As mentioned in recent literature, grounding of a steel tower can easily be done by extending one leg of the tower far enough into the ground where conditions allow of this. A short distance between adjacent grounds is of great importance, as it reduces the inductive effect upon the power wires, when lightning discharge over the ground wire takes place; and, on the other hand, it has an increased tendency to dampen out any high-frequency surge in the power wires proper, caused by switching, short-circuits, grounds, etc.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Information Bureau of the Commonwealth Edison Company.

A general information bureau has been established by the Commonwealth Edison Company at its headquarters, 139 Adams Street, Chicago, in charge of a courteous information clerk. This department is located on the ground floor of the building, directly opposite the main entrance, in a conspicuous place. All orders, complaints and inquiries are first handled here, and the service is proving of convenience to the public. In addition, it is expected that the bureau will prove a distinct help to the other departments, which may secure information of various kinds needed in furthering the business of the company by applying to this department. Previously the contract department maintained an information desk on the second floor of the building, but there was no general bureau of information taking cognizance of all the varied activities of the company.

Advertising.

Mr. John Lee Mahin addressed the members of the Electric Club of Chicago at the weekly luncheon on May 12 on the general subject of advertising. Mr. Mahin gave some of his ideas on this comprehensive subject in an instructive talk. He said that a good salesman's time is too valuable to be devoted to any of the work that an advertisement can do. Advertising is a form of educational work in selling. The merchant is simply an organized salesman. To be a leader he must teach his trade something. Similarly, the salesman should teach the buyer something. In Mr. Mahin's judgment every piece of advertising copy should be subjected to 10 tests, which he enumerated as follows:

1. Does it reflect the spirit of the house? This spirit is not necessarily the expression of any one man, but in a large way it represents the "atmosphere" of the establishment, and it should characterize the advertising.

2. Is it specific? The test of the specific nature of advertising as contrasted with what may be termed generic advertising is that in the latter case if the name of a competitor be substituted for that of the advertiser the advertising would be equally true. If the advertising is specific this will not be the case.

3. Is it timely?

4. Is it pertinent?

5. Is it consistent with the traditions of the house? By this Mr. Mahin meant that the advertising should not be freakish; that is, if the house stands for quality the announcements should lead one to expect that. If it is a bargain house, then the character of the announcement should be modified accordingly.

6. Is it persistent? Continuity in advertising breeds confidence on the part of the buyer.

7. Is it authoritative in tone? The advertising should be neither mandatory on the one hand, nor imploring on the other.

8. Is it institutional? Advertisements are read by large numbers of people, and they should be so worded that an appeal will be made to certain groups who may be expected to see the announcement in the particular medium selected.

9. Is it plausible? In relation to this trait, Mr. Mahin related that someone had remarked to him that if plausibility was to be sought, a confidence man would make an excellent advertiser. To this the speaker answered that if the confidence man only "made good," as the advertisement must do, he would make a "crackerjack" good salesman.

10. Is it sincere? This was the last of Mr. Mahin's tests, and he intimated that no doubt it was the most important of all.

In the brief discussion, Messrs. Frank L. Perry, H. F. Holland and H. E. Niesz took part. Answering a question relating to the proportion of selling cost to be spent in advertising, Mr. Mahin remarked that this depended altogether on the character of the campaign that was undertaken. If people must be educated to buy a new article, the proportion of advertising expense must be heavy, but in case of an old-established line, where the educational work has been done, the advertising is continued in force as an economy in keeping selling expense down. In this case the amount of advertising will be proportionately much smaller. No hard and fast rules can be laid down as to the amount of sales expense to be set aside for advertising. The advertising should not be imitative; it should be original, not only in the preparation of the copy, but in the selection of mediums and the laying out of the general campaign. Some of the most effective advertising of to-day is appearing in the trade and technical press. Every proposition must be handled individually and on its own merits.

New Business at Hoopeston, Ill.

The Hoopeston Gas & Electric Company in the fall of 1907 began a movement to extend its business. The power-plant was first enlarged by the addition of a producer-gas engine and the 125-cycle alternating-current service which had been given previously was changed to 60 cycle, three-phase. Power load, of which the company had connected 150 hp in 500-volt, direct-current motors, was continued by the use of a 56-kw motor-generator set driven by a three-phase, 30-hp, 2000-volt motor. All additional power was taken on the three-phase service. In April, 1909, the company had 325 hp in motors connected, and 50 electric irons out. The population of the town is 5409. The company fitted up an up-to-date office near one of the main streets, the exterior of which is shown in the accompanying illustration.

EXTERIOR OF HOOPESTON GAS & ELECTRIC COMPANY'S OFFICE.

Desirable Summer Business.

Various classes of profitable summer business for the central station were discussed at the meeting of the Commonwealth Edison branch of the National Electric Light Association in Chicago on the evening of May 11. Principal attention was

devoted, however, to furnishing electrical energy for charging automobiles and for operating refrigerating plants. Mr. George Harvey Jones presided, and he announced that the branch had a membership of 390 and that active effort would be made to increase this number to 500. Mr. Jones also made the announcement, which was greeted with applause, that the company had offered to send two men representing the branch to the Atlantic City convention of the National Electric Light Association. These men will be chosen by letter ballot and the result announced later.

Mr. E. W. Lloyd, general contract agent for the Commonwealth Edison Company, read a paper illustrated by diagrams on the subject of "The Relation of the Central Station to the Automobile Business." This was substantially the same paper presented by Mr. Lloyd before the recent Electric Vehicle Conference in Chicago, and given in abstract in the issue of April 8. Before reading his paper, however, Mr. Lloyd gave some interesting figures about the business of providing electricity to the summer amusement parks in Chicago. He said that during the season of 1908 the Riverview Park took 600,000 kw-hours, having a connected load of about 20,000 16-cp lamp equivalents. This year this load will be approximately 25 per cent greater. White City took about 1,000,000 kw-hours, with a load of 60,000 16-cp lamp equivalents. Sans Souci was represented by a consumption of 250,000 kw-hours, the installation being in round numbers 10,000 16-cp lamp equivalents. In addition several other smaller parks are customers of the central station, and in all the revenue from amusement parks last year was about $100,000. In presenting his paper on automobile service, Mr. Lloyd made the interesting statement that the company will make a complete canvass of the electric automobile situation in Chicago this summer. A list will be prepared of all consumers of electricity for this purpose, and it will be carefully analyzed and the information classified so that it may be readily available.

Mr. Ernest Lunn, superintendent of storage batteries for the Commonwealth Edison Company, read a short paper on the general outlook for the electric vehicle, particularly the power wagon. He remarked that the company has 14 electric trucks and more on order. There is no doubt of the practicability of the electric automobile from an economical point of view. Increased life of batteries, improved methods of suspension and improvements in vehicle design have had much to do with the present success of the electric vehicle, particularly the power wagon.

With the aid of a blackboard diagram, Mr. Lunn considered the subject of overcharging vehicle batteries. He recommended that an ampere-hour meter be installed on the automobile. This instrument indicates the amount of energy put into the battery, and can be set for any predetermined amount, the pointer making contact with a contact point and automatically cutting out the source of charging current at the stage desired. One recent improvement has been in the rubber jars holding the cells. Formerly in the company's delivery wagons it was necessary to remove the sediment at the bottom of the jars once in three months. Now, with more space available for the collection of sediment, it is not necessary to do this work more often than once in nine months. In the case of a pleasure vehicle it would not be necessary to clean out the sediment as often as this, and the period of time might even be as long as two years.

Many of the newer trucks have single-motor equipments. The cost of electricity for delivery wagons such as the Edison Company uses is about 2.4 cents a kw-hour. It is interesting to note that the hard-rubber tires used on these vehicles cost about the same in operating service as the electricity to charge batteries. Where pneumatic tires are used it is generally considered that the expense for maintenance and renewals is at least 5 cents a mile in the case of trucks. In answer to a question, Mr. Lunn said that so far as he knew no recent development in the Edison storage battery had been reported.

Mr. Jones, the chairman, spoke of a new type of mercury-arc rectifier used for charging electric vehicles. This new rectifier is arranged so that six sets of automobile batteries may be charged at one time, instead of one set only, as is usually the case with the rectifiers now in common use. With this new outfit several combinations may be made and any number of batteries, from one to six, may be charged at one time. The new equipment is said to be about as efficient as the old one.

Mr. R. F. Schuchardt, editor of the *Edison Round Table*, the new magazine published by the Commonwealth Edison branch of the N. E. L. A., explained briefly the object of this interesting publication in inciting its readers to the highest degree of team work. He took occasion to reveal the fact that Mr. E. A. Edkins was the heretofore unknown "Scribbler" whose little talks in the magazine have received much attention. Mr. Schuchardt praised Mr. Edkins for his valuable assistance, and the latter was called upon and made a plea for active work to increase the membership of the branch.

Mr. Frank Hoffman, of the Contract Department, read an instructive paper on "Artificial Refrigeration." He gave the history of the development of this art and showed how it has improved the conditions of living by making it possible to preserve meats, fruits, vegetables, fish, etc., for use at seasons of the year when these food products would not be otherwise obtainable or would not be capable of long preservation without the use of ice, which is sometimes impracticable. The speaker described the apparatus used and mentioned three types of ammonia condensers. He also gave figures to show the first cost and the cost of operation of refrigerating plants of various sizes, using electrical energy to operate the condenser pumps.

A number of instances were cited to show that after allowing 15 per cent for interest and depreciation, the refrigerating machines, using electricity for power, show a marked economy in operation compared with the purchase of ice, while there are many incidental advantages, such as cleanliness, convenience and the saving of floor space.

Selling electricity to operate refrigerating plants can be made a profitable summer business for the central station. Chicago has a large number of refrigerating machines, but only a portion of them are driven by electric motors. It is evident that the field is not thoroughly developed, especially in the case of small units. Philadelphia central-station interests have been particularly successful in this work. It is a fact that the electric motor is particularly well adapted to drive refrigerating machinery. Ice machines may be run at night by electric motors at very low rates and operated by the watchman in charge of the building, for very little attendance is necessary. Ice can be manufactured by this means for $1.80 a ton, with current at 5 cents a kw-hour and water costing 10 cents per 1000 gal.

Mr. George B. Johnson, of the contract department, called attention to the model motor-driven refrigerating plant in Electric Shop as an actual demonstration of the benefits of the system.

Mr. John F. Gilchrist made the interesting statement that Mr. Hoffman, the author of the paper on refrigeration, was the chief engineer of the first Edison central-station plant in Chicago, dating back to 1882. Mr. J. W. Ferguson announced that it was probable that during the summer the branch would hold a field day with outdoor sports as a variation from the ordinary technical meetings.

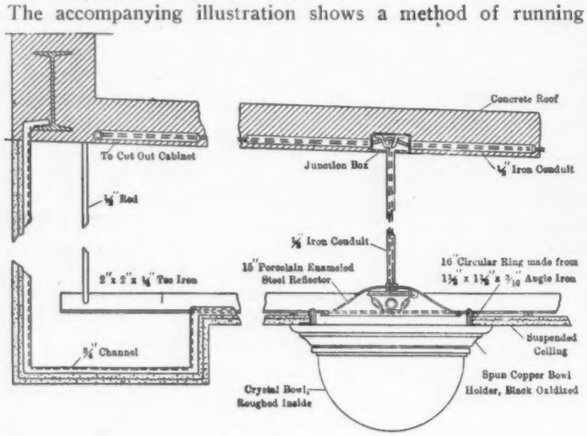
INTERIOR WIRING AND ILLUMINATION

Wiring Rooms with False Ceilings.

There are two general methods at present employed in wiring rooms with false ceilings. Where the falsework is some distance from the supporting floor or roof, it is usual to run conduit on the falsework, if it is of such construction as to be able to carry the pipe, and bring the outlet flush with the plastered ceiling. Oftentimes the falsework is of flimsy plaster of paris

construction so that the conduit must be supported from the floor or roof overhead. However, in the average installation with lath and plaster work, the method of running the conduit on the lath has much to commend it if heavy fixtures are not used, because it is more expeditious than the other method of fastening the conduit to a floor and for all practical purposes makes as good and as reliable a job. As a matter of fact, the average contractor or wireman would rarely run conduit up to the floor or roof and drop to the ceiling, since this requires extra lengths of conduit and wire and extra outlets.

The accompanying illustration shows a method of running


Concrete Roof
To Cut Out Cabinet
Junction Box
½" Iron Conduit
½" Rod
⅜" Iron Conduit
16" Porcelain Enameled Steel Reflector
16" Circular Ring made from 1⅝" x 1⅝" x 3/16" Angle Iron
2" x 2" x ¼" Tee Iron
Suspended Ceiling
¾" Channel
Spun Copper Bowl Holder, Black Oxidized
Crystal Bowl, Roughed Inside

DETAILS OF CEILING CLUSTER.

conduit in a roof and dropping down to the false ceiling through conduit and a wireless cluster. In this case portions of the building, which is a one-story structure, have no ceiling other than the finished roof and inasmuch as these portions are lighted from fixtures fastened to the conduit in the roof, it was not worth while to vary the construction for a single room. The roof in question is of concrete and the conduit was placed in the forms and embedded in the cement. Hung from the false ceiling are 16-in. crystal bowls fastened in spun-copper rims as shown. Angle-iron rims, which support the bowls enclosing the lamps, are inserted in the suspended ceiling and an annular space is left between the bowl and the rim to provide an outlet for the heated air. Above the cluster is placed a white, steel-enameled reflector so that very little light is absorbed. Under the conditions imposed this system of wiring is admirable, although the cost per outlet would necessarily be high.

Animated Electric Sign on Broadway, New York.

At the corner of Thirty-sixth Street and Broadway, New York, a firm of electrical advertisers has erected a small animated sign which is quite effective. The sign is 4½ ft. x 20 ft. 2 in. and contains about 600 lamps of 2-cp rating fitted with color caps. The name of the firm appears in green; the circle in the center of the sign around the transparency is studded with red, white and green lamps; the lightning streaks are in amber and the words "electrical advertisers" are in white. The feature of the sign is the rapidity with which the various combinations are made. There are three consecutive flashes of lightning almost every second. The circle revolves continuously and the transparency which it surrounds is lighted by nine 25-watt tungsten lamps which are flashed on and off. The sequence with which the various lamps burn is as follows: The whirling circle burns all the time; a succession of lightning strokes, three at a time, follow; the firm name is then lighted followed by the transparency and the words "electrical advertisers." All the lamps are then extinguished with the exception of those in the circle and a few streaks of lightning appear, whence the cycle begins again.

Fig. 1 shows the sign as it appears by day and Fig. 2 is a view of the mechanism within the office by means of which the various lighting combinations are obtained. The flashers and switches are driven by a 1/20-hp, direct-current motor. Referring to Fig. 2, the first flasher from the motor is used to produce the revolving wheel effect and runs at high speed. Coupled to this by a reducing gear is the flasher used to produce the streak lightning. This type of flasher makes three streaks a revolution and while it can be run as high as 50 r.p.m., which is as fast as an ordinary incandescent lamp will light up and

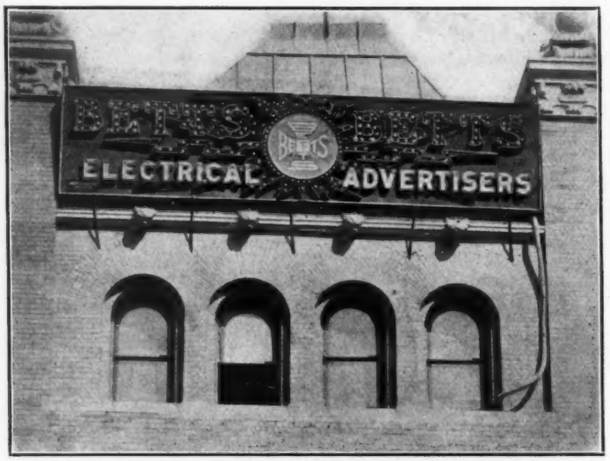


FIG. 1.—DAY VIEW OF SIGN.

extinguish, it is not run quite so fast, 30 r.p.m. being sufficient for lightning effects. There are four circuits on the first flasher and 10 circuits on the lightning flasher. Adjacent to the latter is a main flasher with a double-pole, carbon-point switch for controlling the circuit to the circle lamps and a similar switch for controlling the circuit for the lightning lamps. These switches keep their respective circuits open and closed for definite periods of time. At the end are two three-pole, carbon-point switches; the first controlling the circuit feeding the lamps in the firm's name and the other controlling the lamps in the legend giving the firm's business. These switches give the

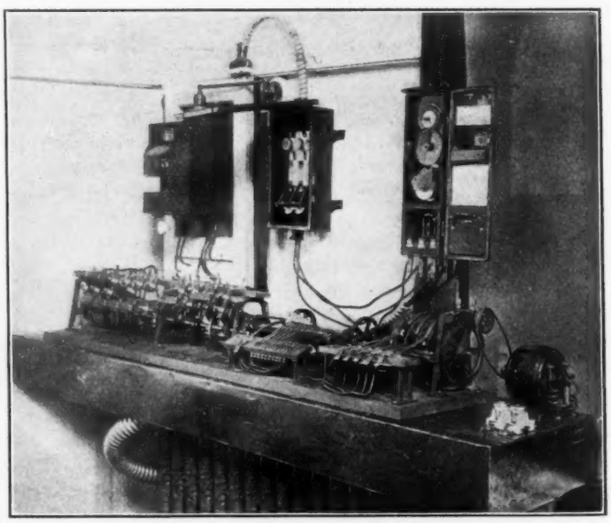


FIG. 2.—VIEW OF ANIMATED ELECTRIC SIGN MECHANISM.

flashing and changeable effect to the sign and are designed especially for heavy loads such as flashing a sign on and off as a whole. Being cut into the mains they do not require each small circuit to be run to the flasher. The flashers are of the Reynolds-Dull type, and by means of the Anderson time switch shown the sign is automatically started at 7 p. m. and extinguished at 1 a. m. The sign is lighted every night and requires about 40 amp at 118 volts.

Electrical Equipment of the Blackstone Hotel, Chicago.

Among the fine modern hotels of the country, few will excel the Blackstone, which is now in course of construction at Michigan Boulevard and Hubbard Place, Chicago. The building will extend 22 stories above the ground and two stories below the street grade, and will present a handsome and dignified appearance. It will contain 400 bedrooms, each with private bath, as well as a large restaurant, private dining-rooms, a ballroom and all the accessories of a modern hotel. The hotel is being fitted up in accordance with the most modern ideas, and its appointments will be elegant. Electricity will be extensively employed for light and power, and the electrical equipment will present several features of interest.

So far as can be estimated at present, there will be between 9500 and 10,000 electric lights. Flaming-arc lamps will be placed on the exterior of the building at the third floor and also around the roof line. It has not yet been determined whether

THE BLACKSTONE, CHICAGO.

the hotel will operate its own electric generating plant or buy electricity from the Commonwealth Edison Company. Tungsten lamps will be used exclusively, and there will be handsome fixtures.

In all the guests' rooms the electric lights will be controlled by a switch in the corridor door, so that when the guest locks the door on the outside on leaving the room, all the lights inside the room will be turned out, thus effecting a saving in electricity which in a large hotel will assume considerable proportions. The lights in the guest rooms will be in the form of table lamps rather than chandeliers, and the brackets on each side of the bureaus will be attached to the bureaus themselves instead of to the walls, thereby allowing these articles of furniture to be moved with greater freedom. Two electric lights will be provided in each bathroom, and they will be mounted on rods and so arranged that the person using the mirrors can raise or lower the lights to a suitable height.

Connections to table lamps and electric heaters will be installed in all the public dining-rooms, but so far as at present arranged, the only cooking by electricity will be done by a number of electric toasters in the kitchen, sub-kitchen and pantries. In the dining-rooms electricity will be employed to operate motors for electric fountains and various electric designs, as well as for keeping dishes hot which come to the table for service.

Six electric elevators will be used in the building, four of these being one-to-one traction elevators for passenger service, and two worm-gear traction-service elevators. The Otis Elevator Company has the contract for installing these machines. There will also be three hydraulic elevators of the plunger type and three electric dumb-waiters of the Burdett-Rowntree design. Electric motors will be used wherever possible to drive the different kinds of machinery, as well as in the kitchen and in the laundry. It may be remarked that the kitchen is on the second floor of the hotel instead of in the basement, as is usual, while the laundry is on the twenty-first floor.

Telephones, of course, will be installed in every room and department of the hotel. One particularly interesting feature is the installation of the most complete and comprehensive telautograph system ever put into any hotel. The Gray National Telautograph Company has the contract for this installation, which will be similar to that used in the Hotel Astor, in New York, but will be even more comprehensive. In connection with the house telephone service, the telautographs will be used to give a direct record of orders transmitted in the routine of hotel service. The Chicago Telephone Company is causing to be manufactured a special telephone switchboard with telautograph keys attached so that the joint telephone and telautograph service will be as prompt and efficient as can possibly be worked out.

There will be an electric carriage call at the Hubbard Place entrance, and the revolving entrance door will be operated by an electric motor, thus obviating the necessity of turning the door by hand.

Time stamps will be used extensively, and there will be a number of electric clocks in the building, although it is not impossible that a portion of the time system may be operated by pneumatic clocks. The watchman service and fire-alarm service will naturally be installed in the most efficient and up-to-date manner.

The Blackstone is being constructed by the Drake Hotel Company, and the entire cost of the hotel and furnishings will be about $2,500,000. The Drake company is controlled by the members of the Drake family and the estate of John B. Drake. Messrs. Tracy C. Drake and John B. Drake, who learned the hotel business in the old Grand Pacific Hotel, under the guidance of their father, the late John B. Drake, are the president and vice-president of the company and the active managers of the new hotel, which will be open to the public early next year. Marshall & Fox are the architects for the building and the George A. Fuller Company is the builder. The architects' consulting mechanical and electrical engineers are L. L. Summers & Company, and their structural engineers are Ritter & Mott. Robert W. Hunt & Company will have charge of the testing of all electric wire used in the hotel.

New Telephone Patents.

NEW APPLIANCES.

Mr. C. Adams-Randall, of New York City, N. Y., has patented a transmitter which is especially designed to permit the user to adjust, by means of a controller, the transmitter efficiency of his station for any particular call. He forms his transmitter of several independent units, each arranged, through the controller, to augment the other, either by means of additional battery or induction coils, or both, as the case may be. The inventor's intention is to have the controller normally seek the position of the lowest transmitting efficiency. If this be insufficient for any call the user will gradually "turn on more transmitter." Upon completion of the call the restoration of the hook-switch will permit the controller to return to normal.

For complete supervision on the two-wire common battery switchboards it has usually been necessary to associate two

relays with each end of the cord pair. One of these effects the initial lighting of the cord lamp, responding to the insertion of the plug in the jack, while the other relay, responding to the connecting subscriber's hook-switch, serves to control the lamp to give the supervisory indications. Mr. W. W. Dean, of Chicago, has patented and assigned to the Kellogg Company an apparatus combining these two relays in one unit. The armature of one of the relays carries the contact anvil, while the armature of the other part carries the contact point. The contact is closed whenever the anvil part is de-energized, while the contact point is energized. When both are energized the anvil is drawn away from the contact, while when neither is energized the contact has fallen back from the anvil.

Letters to the Editors.

The Tariff on Carbons.

To the Editors of Electrical World:

Sirs:—A new joker has been added to the old joker on the method of imposing the duty on electric-light carbons. The first joker was to reduce apparently the rate of duty on electric-light carbons from 90 cents to 70 cents, but instead of basing the new figure on carbons per 100, it was made to apply to 100 ft. This actually raised the duty, as the old rate did not specify the length, and consequently the carbons could be imported in double lengths and cut in two, this, of course, reducing the tariff tax.

Now the latest is an amendment by Senator Smoot, acting for the Finance Committee, which proposes a change to 35 cents per 100 ft. on carbons made of petroleum coke, and to 65 cents per 100 ft. on all other carbons for electric lighting purposes.

This at first sight looks like a material reduction, but in fact it is practically only a reduction of 5 cents per 100 ft., because carbons made of petroleum coke are neither manufactured in Europe nor imported. In other words, a substantial reduction of duty is proposed on an article not imported, while the article which has been imported will, even with 65 cents per 100 ft. duty, be just as much excluded from importation as it would be at 70 cents per 100 ft.

New York. Hugo Reisinger.

Commercial Aspect of Nitrogen Fixation Processes.

To the Editors of Electrical World:

Sirs:—I have read with interest the editorial in your issue of April 22, 1909, commenting on the recent water-power developments in Scandinavia, but I question whether the criticism of the engineers and investors of this continent is, in this instance, well founded.

The writer has given a great deal of attention to the problem of the fixation of atmospheric nitrogen, and in the summer of 1908, acting under the instructions of Messrs. Smith, Kerry & Chace, engineers, Toronto, Canada, made visits to Switzerland and Norway for the purpose of investigating two of the best-known European processes, Messrs. Smith, Kerry & Chace having at that time organized a powerful syndicate to take up this new line of manufacture. The inspections proved to be most interesting and instructive, and particularly that of the plant of the Société Norvegienne de l'Azote at Notodden in Norway, this company having 40,000 hp then at work and having undertaken the development of an additional 225,000 hp.

The capital expenditure on such a plant as that now working at Notodden is, however, enormous and it is only under exceptionally favorable circumstances that the product can be made at a cost that will permit competition with the natural Chilean nitrate. You may recall that Messrs. Bradley and Lovejoy, of Niagara Falls, N. Y., made one of the earliest efforts to develop this business on a commercial scale and were not able to do so successfully.

At the present time, this line of enterprise seems to the writer to be particularly suited to countries which have capital in abundance seeking investment, and a large number of technically trained men whose services can be secured at low cost. The rapidity with which important improvements are being made to the known processes indicates the experimental condition that the industry is still in. Satisfactory experimental plants are of such magnitude and are so costly in operation that they cannot be worked by an individual investigator unless he has great wealth at his command. Furthermore, the processes cannot be worked successfully unless power can be developed at figures comparable to those given in your article, and unless the owner of the developed power is willing to accept something like $7 per horse-power per annum as reasonable rental. There are few powers available in the United States the output of which could not be sold at a much more remunerative rate than this; and we may therefore expect to see the nitrate factories on this continent finally located near some of the great water-powers in the unsettled sections of Canada.

It should be remarked that the patents embodying the results achieved up to date by the European syndicates have been taken out on this continent by the representatives of those syndicates, and that these are more or less basic in character. The writer's experience is, that the syndicates are not willing, at present, to dispose of their patent rights at any price, but these must be secured from them before any American development can be effectively undertaken.

The writer's conclusion is that our neglect of the fixation processes arises from economic causes, and is in no way chargeable either to apathy on the part of our investors or to ignorance on the part of our engineers. The attention of both can for the present be more profitably given to other matters; but it may be but a very short time before this business will become commercially very attractive to us, and then I do not fear that we will be open to further criticism for being behind in technical matters.

Montreal, Can. L. A. Herdt.

The Patent Situation.

To the Editors of Electrical World:

Sirs:—The article, "A Phase of the Patent Situation," by Mr. Barkelew, in your issue of March 18, and those subsequent writers indicate that more discussion is necessary before the serious defects in our patent system will be located. As far as the Patent Office work itself is concerned, there should be no cause for complaint, and anybody who has had dealings with that office must be struck by the discipline prevailing in the various branches and the business-like manner in which all departments are conducted.

Mr. Barkelew enumerates the theoretical sides of the "principles of the patent law as practised in this country," and to illustrate the defects I will take the opening sentences of his first four paragraphs and show the practical, or rather, the impractical side of the same. Time and space will not permit detailed treatment or discussion of the minor changes proposed. These will rectify themselves automatically when the foundation has been made sound.

Mr. Barkelew states, "It may seem superfluous to discuss the general principles of the patent law as practised in this country, but as it has a vital bearing on the subject matter of what will follow it would seem best to make a brief résumé of the inherent fundamentals."

Keeping the fundamentals clearly before us we will not go far astray. The Constitution gives Congress the power *to secure* for a limited time *the exclusive right to inventors* in return for their inventions. To this day Congress merely has passed laws, but has never created or organized any department or institution which could *secure* the rights to the inventor, or the subsequent owner of a patent, as called for by the Constitution.

"The granting of patents is in the nature of a contract, the two parties to the contract both receiving and giving."

This is true in a broad sense. The inventor is compelled to describe his invention in such clear language that anybody

versed in the art can make it. In return for his publication, time, labor and money spent in developing his invention, he gets a piece of paper, but not the protection the Constitution states *should* be given. All that the paper is good for is an identification of the date, description of the invention and the name of the inventor.

"Taking the assumption of personal ownership as a starting point." . . .

In our present social institutions "ownership" means the recognition by others of the article possessed. In fact, it is their "will" that the owner should enjoy the article and in case of theft it is "their will" that the stolen property be returned to the rightful owner. For this purpose we have the police and the courts, or law-enforcing agents; and if a person takes an article in a dry goods store, for instance, without paying for it, the proprietor needs only to call an officer of the law, who will take charge of the thief.

This procedure does not, however, exist in commercial properties, such as patents. Owing to the laxity of our laws and the cumbersome mechanism of securing justice, many people "in the arts" oppose the "will of our institutions" and that of the people at large and simply appropriate the well-described novelty which Congress has not secured to its owner. It is, therefore, not "property," nor can we speak of a "contract" or "personal ownership." People with flexible consciences cultivated into this state by our very laws, which are not supervised, take a bold stand, derive all the benefits belonging to another and if accused, make him the defendant in his own suit—he must prove that he really is the owner. It takes generally from three to five years to show this grain of truth. At the outset it is conceded by both parties to the suit that the court does not understand the technical or scientific side of the subject, which has now so vitally entered in most commercial enterprises and products; for this reason the expert testimony has become so necessary an adjunct to our present litigation. The said grain of truth is buried in a mountain of such testimony which it takes the judge some four to six months to dig out and separate from the surrounding rubbish, if he can recognize it or find it at all. Supposing he has found it, he ponders over the process or device in question, the principles of which are entirely foreign to him, and renders his judgment in accordance with *his* understanding.

How different is that procedure from the method of the policeman who takes his man into the open court where his case is disposed of in half an hour or so!

There have been suits fought on a patent for over 10 years which have cost the defendants thousands of dollars yearly and which, if they had been presented in a court of judges experienced in the art, would have been ruled out in a month.

The negligence of supervision of our patent laws affects not only the individual inventor or manufacturer, but the same go-as-you-please, non-supervision or non-inforcement is detrimental to the whole people of the United States. Who is there to accuse a shrewd man or firm for holding on to a monopoly for a longer time than 17 years; who to act?

Sometimes a broad patent is issued some 8 or 10 years after the first or fundamental patent has been published, thereby giving the firm a further extension of so many years. The later patent stands in the way of public rights. The "public," the "people," are not represented, and if anyone does not like this condition he may start manufacturing and get involved in a suit and foot the bills himself. While he is constitutionally right, he is wrong before the law until he has proved his case. There is no standing commission or department whose attention can be called to such abuses and who would investigate such charges in the interest of the people as a whole at public expense. The Attorney-General, who has acted three or four times in behalf of the people during the existence of our present patent system, is too far removed from the patent situation to be considered a suitable officer to devote much time to patent-law investigation and abuses.

I may now close fittingly with the fourth item selected, which speaks for itself, namely: "The above is the principle of operation of the present system."

ST. LOUIS, MO. L. GUTMANN.

An Early Electric Motor.

To the Editors of Electrical World:

SIRS:—In the report of the meeting of the New York Electrical Society of April 29, contained in your issue of May 6, page 1073, I find a reference to my discussion of Mr. Behrend's paper; and a certain dynamo, designed by me 24 years ago, is referred to therein as "probably the first of its type." This is a little misleading, since the term "type" is now so much used in the sense of *design* or *pattern*.

The dynamo in question was, as I stated in the discussion, the first compound-wound dynamo of any design built and used in this country, so far as I have been able to ascertain. This was its chief and perhaps only merit, especially when seen from the time-point of "20 years after." I was careful to state in my discussion that I am very much more proud of its being "early" than of its excellences of design or "type." It was not only the first but also the last of that "type." The art of dynamo design had not evoluted very long before I was convinced that this design, like all others of its day, was more or less of an abomination. Like the boy who was reproved by the minister for fishing on Sunday, and sought to discount his sin by saying he had caught only one fish and that was very small, I find consolation in the fact that there was only one of those dynamos "perpetrated," and that it was a small one—only 10 kw, if I remember rightly.

I do not feel so much abashed about the *motor*, however. Indeed, as I said in the discussion, I am not ashamed of it;

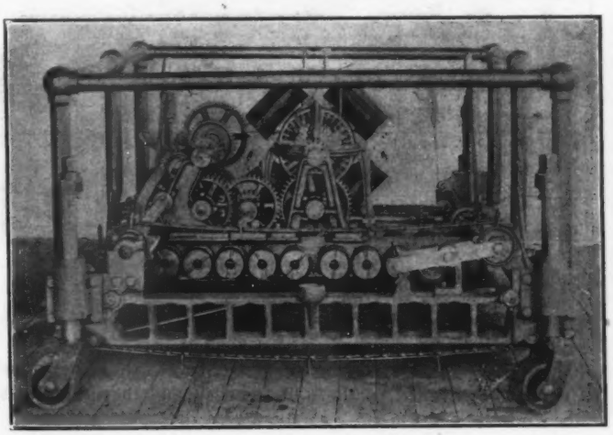


FIG. 1.—FRONT VIEW OF ELECTRICALLY DRIVEN COAL-CUTTER.

on the contrary, I am proud of it even now, because it was really an "achievement" for its day, and for many a day after. I said that I had preserved a picture of this motor which I was not ashamed to show. As this pioneer design may be of interest to some of your readers, I send you herewith two photographs of the "Lucas" coal-cutter, which was equipped with the motor in question.

Fig. 1 shows the front end of the machine. This view shows the commutator end of the motor, both of the *two* brush-holders being visible. The coal-cutting machine was designed to bore 10 parallel holes as closely as possible to each other into the coal so as to form a sort of horizontal "undercut" in place of the undercut made by the miner by the pick. In Fig. 1 the 10 augers or drills are removed, the ends of the 10 driving shafts for them being visible, and also the square openings through the frame through which these augers passed. The entire mechanism moved on guides as fast as was supposed to be right to "feed" the augers into the coal. Fig. 2 shows the rear of the machine after the augers have been fed in. All the gearing shown served for conveying power from the motor to the augers and to the feed-mechanism.

The makers and the owners of the machine were unable to find any motor manufacturer, large or small, in this country, to undertake the responsibility of designing or building a motor suitable for this machine in 1884. The design was undertaken

by the firm of Mailloux & Rae, and was made by the writer in October and November, 1884. The motor was constructed at the works of J. H. Bunnell & Company, and was completed in the early part of 1885, together with the dynamo above mentioned. They were both put in operation in a coal mine at Saltsburg, Pa., in the spring and early summer of 1885.

According to the agreement made with the owners of the machine, the design was not to be paid for unless certain requirements were fulfilled by the motor, to the satisfaction of a disinterested expert, if necessary. The requirements agreed to were severe enough to try the skill of a good motor designer of even 10 or more years later. They included the following features: The motor must be adapted to its location and its shape must be such that it will utilize whatever space is not needed for the gears or for access to them or for "maneuvering" the machine (this machine being, of course, already made and without reference to the motor); it must not exceed 27 in. in height and (about) 30 in. in axial length; the motor shaft must have a certain relation to the mechanism for driving and feeding the augers; the total weight of the motor and of the reduction gear must not exceed 250 lb.; the speed must not

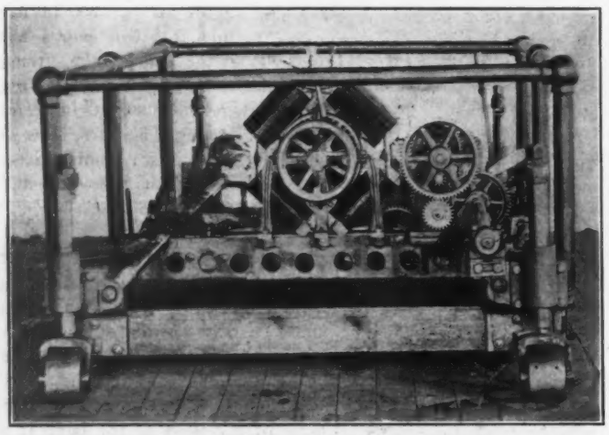


FIG. 2.—REAR VIEW OF ELECTRICALLY DRIVEN COAL-CUTTER.

exceed 750 r.p.m.; the power output must not be less than 2½ (2.5) brake-hp.

These requirements were *all* complied with to the satisfaction of an expert engaged by the mine owners, and the design was duly paid for. If the state of the art of motor design at that period is taken into consideration, the designer of this motor feels that he has reason to be proud rather than ashamed The motor was certainly the first multipolar motor designed, built and put in operation in this country. Moreover, it was also the first multipolar motor with cross-connected commutator, and requiring only two brushes. This feature was an original invention of the writer, who, however, discovered on trying to get a patent, that Mordey was a little ahead of him. This motor had wrought-iron field cores and cast-iron pole-pieces. The armature was of the Pacinotti slotted type, with 32 sections only. It was designed for operation as a series motor with a starting resistance, on a constant-potential circuit of 350 volts at the dynamo terminals, or about 300 volts at the motor with full load. This was very high tension for that time. The pole pieces were given a great deal of attention so as to obtain good commutation. The results were satisfactory enough; the motor did not flash over at any time and it did not spark as much under full load and overload as many motors of much later "vintage." In the brake tests the load was run up to over 4 brake-hp for short periods without difficulty. The efficiency (which, of course, was *not* guaranteed), ranged between 40 per cent and 70 per cent, according to the load, the best efficiency being obtained at a little under 2 hp.

As first tried with the coal-cutting machine (as originally built), the results were negative. This was naturally a great disappointment to the inventor and to the owners of the machine, who did not hesitate, of course, to blame the motor. The writer, however, foreseeing this, had insisted on a limiting or maximum power output being agreed to, and had refused to guarantee that the machine would operate as a coal-cutter with that or with any power whatever. Dynamometer tests made of the machine, but not cutting coal, had indicated that the power required should not exceed 1.5 hp or 2 hp. Hence, 2.5 hp was deemed ample margin. The tests showed invariably that after starting to bore the coal and running with a low current for a short time until the augers had entered the coal to a depth of an inch or two only, the current would rise rapidly until the fuses blew. The fuse limit was raised until the input at the time the fuses blew exceeded 7 kw or 8 kw, with very little improvement in the result. Moreover, the number of augers was reduced until one only remained, without material benefit. This led the writer to the conclusion that there was something radically wrong about the "boring." A few experiments made with a drill set in the chuck of a lathe and fed into a chunk of coal at various rates of feed soon elucidated the mystery, by showing that the augers were *driven* too fast (600 r.p.m.) and were *fed* too slow (1/64 in. per turn). This caused the drills to "glaze" the coal without cutting, so that after a few turns the feed merely increased the pressure against the bearings until the power available could no longer produce motion. The writer, having discovered the trouble, was retained to rearrange the "gear-ratios." The rotating speed of the augers was reduced to about 60 r.p.m.; and the feed was increased to about ¼ in. per turn of the augers. It then became possible to make complete borings with all the augers, with less than 3 hp. This did not prevent the machine from being a failure, nevertheless, because the holes made by the augers left too much coal between them, necessitating too much hand work to complete the "undercut."

The motor had "made good," but the coal-cutter had not; and both found their way to the "grave-yard" together. The motor, as the writer sincerely believes, deserved a far better fate. Many a design, poorer and less original in all respects, served, later, as the pretext for some stock company that flashed like a meteor for a brief period over the electrical horizon and left only "smoke" and worthless paper behind. This motor had the fate of the many a flower

"That is born to blush unseen,
And waste its sweetness on the desert air."

And so, I thought I would take this opportunity to give this unfortunate, precocious motor a decent burial. Requiescat in pace.

New York. C. O. Mailloux.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

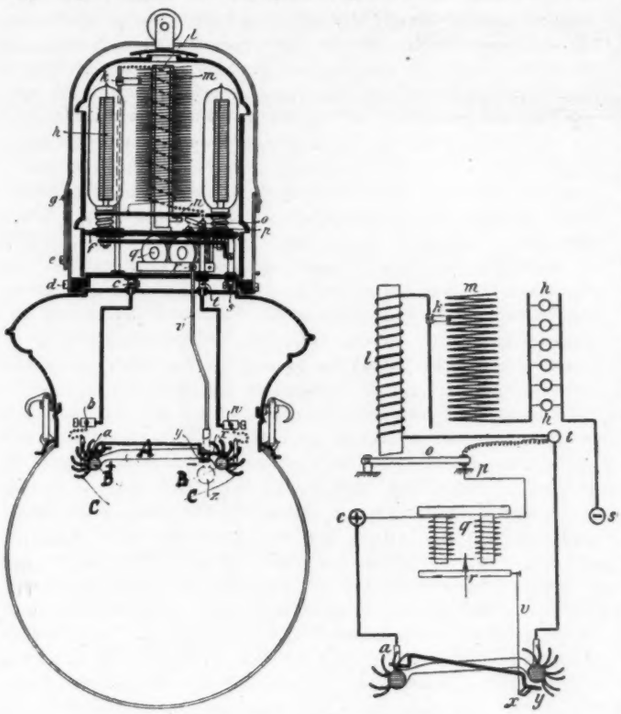
Turbo-Alternators.—An illustrated description of a 32,000-kv-amp turbo-alternator recently installed in the electricity works of the Aston Manor Corporation. The construction of the rotor is particularly interesting on account of the high speed at which it runs (1500 r.p.m.). It has salient poles, but no separate pole-shoes, and the spaces are machined out of the solid. The shaft is forged in one piece with the rotor. The characteristic curves of the machine are given from which it is seen that the voltage rises 4.5 per cent, when full non-inductive load is thrown off, and 15 per cent with a full inductive load of 80 per cent power factor.—Lond. *Elec. Eng'ing*, April 29.

Polyphase Commutator Motors.—E. Roth.—The conclusion

of his long mathematical paper on the theory of polyphase commutator motors with shunt excitation. In the present instalment the author discusses the most general case and gives the circular diagram for this case.—*La Lumière Elec.*, April 24.

Lights and Lighting.

Quartz Lamp.—O. BUSSMANN.—An illustrated description of the latest form of the Küch quartz lamp. This lamp is essentially a mercury-vapor lamp with a quartz tube, the specific consumption being 0.2 watt per hefner cp, and the life being 2000 or 3000 hours, or even up to 6000 hours. The high efficiency of the lamp is due to the high temperature of the mercury vapor which is estimated at 5000 C. or 6000 C. The



FIGS. 1 AND 2.—QUARTZ LAMP.

mechanism of the quartz lamp serves only for starting, not for regulating the lamp, and is therefore very simple and hardly subject at all to wear and tear. Fig. 1 is a cross-section of the lamp and Fig. 2 shows the connections of the circuit. The quartz tube *A* has at each end a closed cylindrical vessel *B* filled with mercury. The connections to the external circuit are made through the walls of *B* with the mercury. *C* are metallic leaves for cooling the ends of the lamp. The other letters refer to the same portions of the lamp in both illustrations. The quartz tube is held on its axle *a x* in bearings. By means of the lever *v* the tube is connected to the armature *r* of a shunt magnet, *q*. On closing the circuit, the armature of the shunt magnet is attracted and the quartz tube so tilted that the mercury flows over from the upper end to the lower end and closes the circuit. Current now passes through the mercury in the tube. This current magnetizes the inductance coil *l* which attracts the armature *o* and thereby opens the circuit of the tilting magnet *q* at *p*. The quartz tube now returns into its original position, the mercury separates again into two parts and an arc is formed. The process is exactly analogous to the starting of an arc lamp in which the two carbons are first brought into contact and then separated from each other. But in the quartz tube the arc would not remain lighted if there was air in the tube. The arc will then be broken, the tilting mechanism will act again, a new arc will be started and more mercury will evaporate. This will be repeated until there is sufficient mercury vapor in the tube to maintain the arc. But this occurs only if the quantity of air in the tube is small. If it is beyond a certain limit, a sufficient quantity of mercury cannot evaporate and the starting mechanism will continue to operate, the arc being lighted and extinguished in regular intervals until the lamp is disconnected. Since the resistance of the arc changes, it is necessary to use a series resistance. This consists of iron wires in a hydrogen atmosphere represented by *h* in the illustrations. The choking coil *l*, besides acting on *o*, also serves for another purpose. Mercury-vapor lamps are sensitive with respect to voltage variations, and if in a network the voltage drops suddenly by several volts when some large motors are connected to the circuit, the current in the quartz lamp is liable to drop so as to extinguish the lamp. The tilting mechanism would then act again, but the temporary extinction of the lamp would be troublesome. The inductance coil *l* produces in case of a certain drop of current, a rush of current in the same direction so that the lamp remains lighted. Fused quartz has a zero temperature coefficient of elongation. For the connections through the walls, a metal of zero coefficient must, therefore, also be used. This is nickel steel. It is cut in form of cones and these are tightly set into corresponding holes in the wall, a tight fit being assured by applying some mercury and covering the joint on the outside with some material which prevents the mercury from flowing out and evaporating. The commercial quartz-tube lamp for 100 volts to 130 volts consumes 4 amp and 85 volts, giving 1200 hefner candles. For voltages between 200 and 250 two lamps are made, one for 2.5 amp and 160 volts at the quartz tube, giving 1500 hefner candles, the other for 3.5 amp and 280 volts, giving 3000 hefner candles. The excess voltage is consumed in series resistances in the same way as in arc lamps. There are now in preparation four models for interior lighting for semi-indirect illumination, absorbing 2.5 amp and 4 amp at 110 volts and 1.5 amp and 2.5 amp at 220 volts, respectively.—*Elek Zeit.*, April 29.

Enclosed Flame-Arc Lamp.—A note on a recent British patent (8304, 1908; April 22, 1909) of W. J. Davy for preventing a deposit on enclosed flame-arc lamp globes. The arc is surrounded by a glass cylinder, which extends down nearly to the bottom of the inner enclosing globe. No deposit is formed on the interior of this cylinder, as it is kept hot, and, furthermore, there is a strong draught of air along the inner surface. Above the bottom plate of the body of the lamp is a metal cylinder which surrounds the cylindrical chamber containing the controlling mechanism. Air passes up through the glass cylinder, past the arc, up between the metal cylinder and the mechanism chamber, then down between the metal cylinder and the outer case, and finally through perforations in the metal ring between the glass cylinder and the inner globe into the latter. The chemical residue is deposited on the cool metal surfaces. Four small-flame carbons in a parallel are used on the top, and one large plain carbon below, this preventing failure to strike due to a deposit of silica on the lower carbon.—Lond. *Elec. Eng'ing*, April 29.

"Tubolite" Lamp.—An illustrated note on the tungsten tubolite lamp. A straight length of about 7 in. is fixed in the tubu-

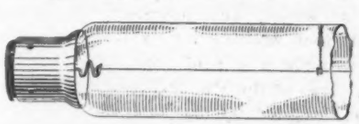


FIG. 3.—END OF LAMP SHOWING SPRING ATTACHMENT AND ONE INTERMEDIATE SUPPORT.

lar lamp in the manner illustrated in Fig. 3, which shows one end of the lamp and one of the two intermediate supports. The lamp is rated at 12 cp, 25 volts, and consumes 1.45 watts per candle, this consumption remaining constant throughout the whole life of the lamp, which, as far as is known at present, extends to 1000 hours. If the consumption is measured in front of the reflector it works out to less than 1 watt per candle. To take up the expansion of the filament, it is supported at both ends by six zigzag springs of strip metal.—Lond. *Elec. Eng'ing*, April 29.

Tungsten Filament.—A note on a recent British patent (17,438, 1908; April 22, 1909) of Siemens & Halske Company

for making a tungsten filament from tungsten-nickel alloy. A ductile alloy of tungsten and nickel is obtained by intimately mixing the two metals in the form of powder or reducible compounds, and then sintering the product together by heating below the melting point of tungsten. A suitable alloy, which may be rolled and drawn into wire, contains 10 per cent nickel, and if a pure tungsten wire is required, the nickel can be removed after drawing by heating the wire by passing a current through it in a vacuum. The powdered metals or compounds are pressed into rods 1 mm to 2 mm in diameter, and these are heated in quartz tubes through which hydrogen is passed. The temperature is raised gradually up to about 1600 deg. C. and kept so for some minutes, during which time the rods are converted into an alloy of tungsten and nickel.—Lond. *Elec. Eng'ing*, April 29.

Vacuum Meter.—H. J. Reiff.—A fully illustrated article on a vacuum meter, based on the principle of MacLeod, and its use in incandescent-lamp factories.—*Elek. Anz.*, April 22, and 25.

Power.

Steam Engines.—The (British) Engineering Standards Committee has issued a report on reciprocating steam engines for electrical purposes, which is intended to assist engineers and makers of steam engines for electrical purposes to a mutual understanding. The steam pressures specified as standard are 100 lb., 150 lb., 200 lb. and 300 lb. per square inch, and these are defined as low pressure, intermediate pressure, high pressure and extra high pressure, respectively. The following exhaust pressures are recognized as standard: 15 lb. per square inch absolute (non-condensing), 2.5 lb. per square inch ("medium" vacuum), and 1.5 lb. per square inch ("good" vacuum). A table of standard speeds for various outputs from 30 kw to 1000 kw is given. The clauses on cyclic speed variation and governing are as follows: "The maximum permissible variation in speed of the generator, when direct coupled to a steam engine, throughout one revolution—that is to say, in the amount the rotating part forges ahead plus the amount it lags behind the position of uniform rotation—shall not exceed one-thirtieth of the angle between the two poles, i.e., the angular variation shall not exceed: 6 deg. in a two-pole machine, 1.2 deg. in a 10-pole machine, and so on. The maximum temperature increase or reduction in speed, due to suddenly taking off or throwing on the whole load, shall not exceed 10 per cent of the standard full-load speed, and the continuing alteration in speed shall not exceed 5 per cent of the standard full-load speed. Also the maximum temporary variation in speed due to the load being varied gradually, or by steps not exceeding 20 per cent of the rated load, shall not exceed 5 per cent of the standard full-load speed." The standard continuous overload capacity is given as 20 per cent.—Lond. *Elec. Eng'ing*, April 29.

Electric Energy from Peat.—K. B. Eller.—A brief note on a peat power station which was erected at Skabersjo, in Sweden, in 1903, and has now been working for over five years. The bog which supplies the peat is only small, about 37 acres, with an average depth of 5 ft., and is estimated to last for a period of 30 years. There are two suction-gas producers and two gas engines, with direct-coupled electric generators of 150 hp each. The power is conducted from Skabersjo to Svedala, a distance of two to three miles, and there some of it is used for lighting the streets and some is distributed to mechanical works and several small industries. Although the by-products, with the exception of tar, are not recovered—the plant not being large enough to make this remunerative—the cost of production is very low. The price of power paid by the consumers is, besides a small yearly charge per motor, 2 öre (= about ½ cent) per hp-hour.—Lond. *Engineering*, April 30.

Water-Power Transmission to Paris.—A. Blondel.—A paper presented to the French Association for the Advancement of Science on the scheme of Blondel, Harle and Mahl, of transmitting electrical energy from the Rhone River to Paris. It is estimated that about 1,000,000,000 kw-hours could be transmitted to Paris every year. Two systems are especially compared: the direct-current, high-tension series system of Thury and the three-phase system. While the author does not reach any definite conclusion, he appears to look on the Thury system quite favorably.—*La Revue Elec.*, April 30.

Traction.

Electrification of Railways.—J. A. F. Aspinall.—An abstract of his presidential address to the (British) Inst. Mech. Eng. The general question of the desirability of converting existing steam railways to electrical working is first discussed, after which the Liverpool-Southport electrified section of the Lancashire & Yorkshire Railway is described, where electrification was resorted to "not to save money, but to make money." If this course had not been followed it would have been necessary to increase the terminal facilities. By electrification both the platform operations and the signal operations per train are reduced to one-half the number necessary for steam trains, and thus the capacity of the terminal stations is doubled. Before the electrification of the Liverpool-Southport line, the six-wheeled, coupled tank locomotives consumed 80 lb. of coal per train-mile with express trains and 100 lb. with stopping trains, these heavy figures being due to the high acceleration required. On the other hand, the consumption of coal at the power station in 1908 was found to be only 49 lb. per train-mile for the electrical trains. Another interesting point is that of rating. Apparently a steam electrified railway stands at an advantage, because the rating law, in dealing with the "hypothetical tenant," considers the steam locomotive as part of the tenant's capital, and therefore allows a deduction from the rate, but in the case of an electrified railway the power station is rated separately, and this increases the annual expenditure. With electric rolling stock, the center of gravity has been brought low and a greater proportion of the weight is not spring-borne. The result is a greatly increased wear of tires and rails. This defect could be remedied by raising the motors and transmitting the drive in some other way. The wear would be reduced, but, on the other hand, the drive would be less direct and less efficient, and the construction of the motor-cars would be more difficult. Concerning the cost of operation the author makes the following remarks: Any railway company having the opportunity of putting down its own plant in the country with ample facilities for getting cheap coal and water should be able to produce current at the generating stations at a "works cost" of less than 0.5 cent per kw-hour, the coal consumption being under 3 lb. per alternating-current unit. With such figures as these, it is possible to work a high-speed service at 19 cents per train-mile, including "works cost" for the power house, substations, battery stations, "operating costs," for motor and electrical equipment, repairs, car repairs, guards' and motormen's wages, lighting and heating of cars, repairs of third and fourth rails, bonds and cables, and all working stores. The cost per car-mile varies between 5.5 cents and 6 cents according to the number of cars run. The total current-producing charges, including conversion at substation, the cost of battery stations and depreciation of batteries, absorbs 9.04 cents out of the 19 per train-mile. With the exception of the depreciation of batteries, no sum is included for depreciation of plant or for interest on outlay. The above figures are not intended to, and do not, include any part of the cost of maintaining the running track, the passenger and goods stations, or costs for the platform staff, or any other items required for the railway, whether worked as a steam line or as an electric line. The great economy to be hoped for in the future for electrical railways, where no water power is available, is in the production of electricity in very large quantities. Further economies may be sought in improvements of the motors so as to reduce the cost of repairs and in improvements of the whole design of the improved truck.—Lond. *Electrician*, April 30.

Electric Locomotive.—An illustrated description of an experimental locomotive which has been built at Schenectady, the distinguishing feature of which is the use of motors mounted above the frames and coupled to the driving wheels by connecting rods and side rods. The locomotive is to be equipped with two 800-hp, 15-cycle, single-phase motors, with a tractive effort of 30,000 lb. at 18 miles per hour.—*Elec. Rail. Jour.*, May 8.

Overhead Conductors.—P. DAWSON.—In a continuation of his long illustrated serial on electric traction of railways, the author deals with overhead construction and discusses especially the design of insulators and the suspension of the trolley wire.—Lond. *Electrician,* April 30.

Thury System for Traction.—BOURDEL.—An abstract of a paper read before the International Association of Electricians in Paris on the principal features and equipment of a direct-current, constant-current traction system, all the motors being in series according to the Thury system.—*L'Industrie Elec.,* April 25.

Installations, Systems and Appliances.

Paris.—A. SOULIER.—Since 1889 the supply of electrical energy in Paris has been in the hands of six large companies. In 1907 the municipal board decided to take over the electrical supply, but since the certain introduction of one uniform system would have involved enormous inconveniences, it was decided to adopt a transitory system for the period from 1907 to 1913. For this purpose the city of Paris was divided into four zones: the first being equipped with the three-wire direct-current system; the second with the five-wire direct-current system; the third with the single-phase alternating-current system, and the fourth with the two-phase system. To supply these different zones with electrical energy single-phase currents will be generated at 3000 volts and two-phase currents at 12,300 volts at a frequency of 41 2/3, and will be transmitted to various substations.—*L'Industrie Elec.,* April 25.

Tariff for Electrical Energy.—L. GEORGE.—The first part of an article classifying and discussing the various systems of charging for electrical energy.—*L'Industrie Elec.,* April 10 and 25.

Water Rheostats.—F. LOBBE.—An article giving formulas and drawings for water rheostats, especially for use on three-phase systems.—*L'Industrie Elec.,* April 25.

Wires, Wiring and Conduits.

Aluminum and Bimetallic Conductors.—E. F. NORTHRUP.—A long and valuable paper in which the author points out the complications due to the fact that besides ordinary solid, round copper conductors, there are now on the market stranded, aluminum and bimetallic conductors. This variety of competing conductors, when taken in connection with the two methods in vogue of defining conductivity, has led to a certain confusion of ideas as to the precise meaning of conductivity and the best way of determining and stating the relative worth to the user in dollars of conductors of different qualities and types. After a general introduction on conductivity, the author explains the two different definitions of Matthiessen's standard of conductivity and sums up the relations which exist between the general and specific properties of conductors. He then deals in detail with bimetallic conductors, and the comparative money value of different types of conductors. He takes as standard of value the market price of a given length and weight of copper. It is then easy to express the value to the user of any other conductor, as one of aluminum, or of bimetallic conductors, as compared with this copper conductor. The value to the purchaser will be the value of the conductor as a conveyor of electric power as compared with the value of a specified copper conductor. If the conductor considered has value additional to its power-conveying capacity, such as superior tensile strength, then this must be separately considered and allowed for. The measurement of conductivity is then discussed and in the appendix a summary is given of the many formulas derived in the article.—*Electrochem. and Met. Ind.,* May.

Heating of Cables.—L. LICHTENSTEIN.—The standardization rules of the German Association of Electrical Engineers cover the permissible maximum current in underground cables for voltages up to 10,000. In order to get data for higher voltages the author has made experiments with eight different cables with a single core and with three conductors. The results are given in diagrams and the following tables are derived for the permissible currents. The first table relates to single-core cables with about 5 mm insulation thickness. The first column gives the cross-section in square millimeters (1 mm = 39 mils); the second the permissible maximum current in amperes for non-armored cables, and the third column the permissible maximum current for armored cables, buried in the ground.

Sq. mm.	Amp.	Amp.	Sq. mm.	Amp.	Amp.
16	104	100	50	208	200
25	136	130	70	256	246
35	168	161	95	308	295

The next table relates to three-core cables with 17 mm insulation thickness, the cables being buried in the ground:

Sq. mm.	Amp.	Sq. mm.	Amp.
25	82	70	150
35	100	95	175
50	120	120	205

The first column represents again the cross-section in square millimeters, and the second column the permissible current in amperes.—*Elek. Zeit.,* April 29.

Cable Papers.—C. BEADLE AND H. P. STEVENS.—The conclusion of their long paper on the composition and durability of cable papers. The authors discuss the methods of manufacture and composition of cable papers and ash determination. They finally mention that papers impregnated with rosin oil may deteriorate when heated in contact with air, but that no deterioration probably takes place if the heating is carried out not in contact with the atmosphere, as in lead-sheathed cables.—Lond. *Electrician,* April 30.

Electrophysics and Magnetism.

Radio-Active Elements.—STRÖMHOLM AND SVEDBERG.—The chemical characters of most of the radio-elements are only imperfectly known. It has been found that some of them accompany certain well-known elements in precipitation, while others volatilize at high temperatures. Whether the volatilized substances are the uncombined elements, their oxides or other componds are unknown, while in the case of precipitations the phenomenon of absorption may play an important part in such exceedingly low concentrations as exist in these cases, so that conclusions in regard to chemical relations must be drawn with caution. In view of these circumstances, the authors have undertaken a study of the subject by the use of isomorphism. As an example of the behavior of normal elements, the following experiments were made: To equal portions of a warm saturated solution of barium nitrate, equal amounts of dilute solutions of silver, mercuric, lead and bismuth nitrates were added, and after cooling it was found that the crystallized barium nitrate contained neither silver, mercury nor bismuth, but it had taken up much lead in solid solution. From a similar series of experiments with potassium nitrate none of the above-mentioned metals showed a solubility in the solid phrase, while in the case of sodium nitrate a considerable amount of silver and a little lead were found in the crystals. The authors applied this method to a solution of Rutherford's thorium X and found that this element is isomorphous with barium and lead, that it follows barium in its precipitations, and therefore belongs to the alkali-earth group of metals. Similar experiments with thorium nitrate solutions gave less definite results on account of the numerous radio-active bodies present in such solutions, but it is the purpose of the authors to extend their studies by this method to other series of radio-active elements.—Abstracted from *Zeit. f. anorgan. Chem.,* Vol. 61, p. 338, in *American Jour. of Science,* May.

Discharge Tube.—J. J. THOMSON.—A lecture before the Royal Institution on electrical striations. The author describes the apparatus by means of which he explored the electric field in the discharge tube. The different colors observed in the striæ are due to two causes: First, a difference in local temperature or speed, low temperatures give a reddish glow, higher temperatures a bluish glow. There is, secondly, a separation of colors with regard to the different gases in mixtures.—Lond. *Electrician,* April 9.

Electrochemistry and Batteries.

Caustic Soda and Chlorine.—F. G. DONNAN, J. T. BARKER AND B. P. HILL.—An illustrated Faraday Society paper on the Finlay cell for electrolysis of alkali-chlorides. It is a diaphragm

cell with two diaphragms and three compartments. The middle compartment between the two diaphragms is filled with fresh brine and this is pressed into the anode as well as the cathode compartments. In this way the anodic and cathodic products of electrolysis are kept separate from each other. The authors give details of the current and energy efficiency of this cell.—Lond. *Electrician,* April 30.

Nitric Acid from Air.—Schoenherr.—An illustrated paper read before the Berlin Electrical Society on the new process of the Badische Company for the fixation of atmospheric nitrogen. —*Elek. Zeit.,* April 22 and 29.

Ferrochrome.—J. Escard.—A continuation of his article on methods for the manufacture of ferrochrome. He refers briefly to an electrolytic method and then discusses the aluminothermic process, and emphasizes finally the importance of the ferrochrome industry.—*La Lumière Elec.,* April 24.

Units, Measurements and Instruments.

Leakage Switch.—An illustrated description of an instrument of English make, intended to safeguard against leakage to earth on an electrical installation, which may not suffice to blow the fuses, but may cause a fire. The instrument detects a leakage on either wire, and deals with it by opening the circuit on both poles. As shown in Fig. 4, the instrument consists of a differential relay, trigger and set of tumbler switches. The relay consists of two moving coils $C_1 C_2$, as used in ammeters, which are mounted on a common spindle, electrically divided in the middle. The coils are respectively connected in shunt to two small resistances B_1 B_2, which are traversed by the main current flowing to the installation; when the lead and return currents are equal, the torque on each coil due to the bar-magnets and the shunt current is the same, and as the coils are connected on opposition they remain at rest. But if a leakage occurs on either side of the circuit the balance is upset and the coils rotate, bringing the tongue *p* into contact with one prong of the fork, and completing the circuit through relay *m*. The latter lifts the trigger *m* and releases the arm of the switch *b*, which, being pulled by the spring *s*, flies over to the left and opens both switches, *A* and *B*, which are coupled by the insulating link *e'*. The switches can be closed by pulling the handle *H* outside the case, which first opens switch *C* and then, by means of the slotted link *f*, closes *A* and *B*, which are held closed by the trigger. The circuit cannot be closed, however, until *H* is pushed home again, leaving the instrument set as at first. If the leak is still on, the trigger is at once lifted and the circuit broken again, so that it is impossible to leave the installation alive and in a dangerous condition. Less than a quarter of an ampere difference between the lead end and the return currents suffices to actuate the instrument, no matter how great these currents may be. Ordinary tumbler switches, moving coils, etc., are employed in the construction of the apparatus.

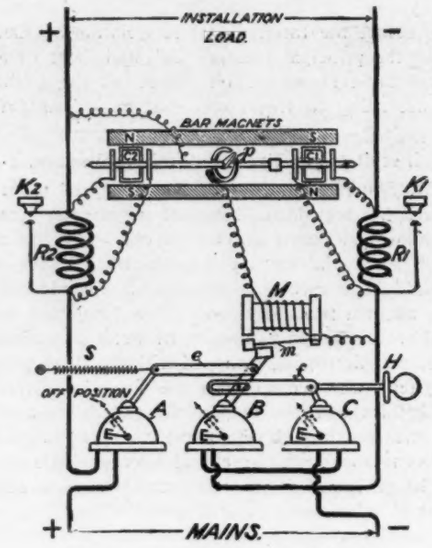


FIG. 4.—DIAGRAM OF CONNECTIONS.

which may, therefore, be expected to prove reliable in use. The keys K_1 K_2 serve for testing the instrument by short-circuiting the resistances.—Lond. *Elec. Review,* April 30.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—Count Arco.—A description of a new system of wireless telegraphy used by the Telefunken Company. It is a compromise between the "spark" and the "arc" systems. Technical details of the equipment used are not given, but its practical and technical advantages are fully discussed. Among these are that the use of small antennæ is possible, a high efficiency is obtained and large powers can be employed, while electrically the arrangement is much more free from disadvantages than are the older systems. There is very great freedom from disturbance, and messages can be made quite "private," while the signals are transmitted as clear as musical tones.—Lond. *Electrician,* April 30.

Wireless Telephony.—Henry.—An article dealing with the system of Majorana and Collins.—*L'Industrie Elec.,* April 25.

NEW APPARATUS AND APPLIANCES

Tungsten Lamp Shade-Holder.

The Tregoning Electric Manufacturing Company, of Cleveland, Ohio, has just placed on the market a new shade-holder,

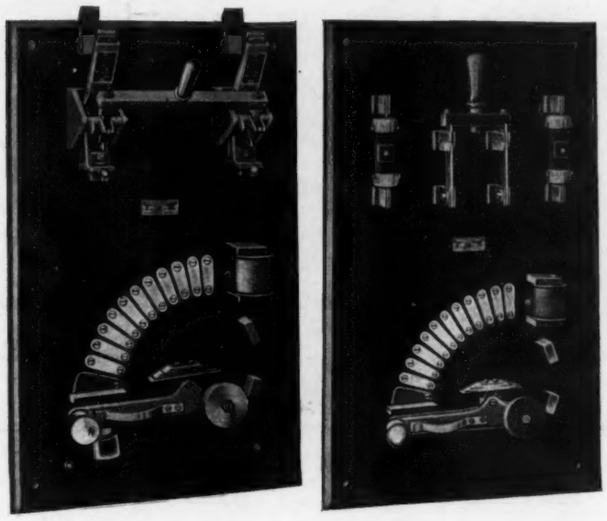
TUNGSTEN LAMP SHADE-HOLDER.

for use in connection with tungsten lamp shades. It is of one piece, perforated shell, and has a security snap lock, preventing the holder from becoming detached when subjected to vibration. One of its features is the simplicity with which it is attached to the socket and shade, this being accomplished by a slight pressure of thumb and finger. Attachment of the holder to the shade and socket is obtained simultaneously. Separate parts, such as thumbscrews, collars, wire rings, etc., are eliminated, the method of locking and securing the socket and shade to the holder being embodied in one piece.

Starting Panels for Direct-Current Service.

The use of starting panels for direct-current motors instead of a starting rheostat with separate switch and fuses is becoming quite common in a large number of industries, mainly because the panel insures a more satisfactory location for rheostat, fuses, switch or circuit-breaker than is often accorded to some of these parts when mounted separately. A line of starting panels has recently been placed on the market by the West-

inghouse Electric & Manufacturing Company, ranging in capacity from a starter for a ¼-hp motor at 110 volts to one for a 120-hp motor at 220 volts, including panels for 500-volt circuits. These panels are made up in several different styles and



FIGS. 1 AND 2.—STARTING PANELS.

can be mounted with wall brackets or on tubular supports resting on the floor.

Each panel consists of a slate slab on which are mounted the rheostat contacts and contact arm, the main switch and fuses or the circuit-breaker. In the smaller sizes the resistance is mounted on the back of the panel, but in the larger sizes it is

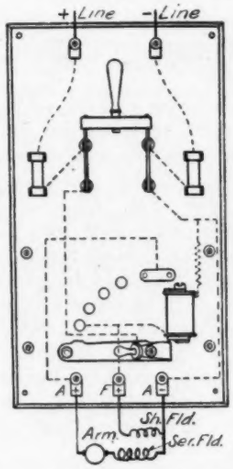


FIG. 3.—DIAGRAM OF CONNECTIONS.

mounted separately. Five terminals are provided for connection to the line wires and the motor leads, and are plainly marked so that it is difficult for a man, even if unfamiliar with starting apparatus, to make a mistake in connecting, especially as a diagram is sent with the starting panels.

Fig. 1 shows a starting panel with a carbon-break circuit-breaker, and Fig. 2 shows another panel with the same arrangement of face-plate contacts, etc., but which has a main switch and fuses instead of a circuit-breaker. All sizes are provided with low-voltage release devices which automatically return the contact arms to the starting position on interruption of the power. Fig. 3 shows the diagram of connections for a panel for a 1¼-hp motor. It will be noted that the low-voltage release coil is independent of the field circuit, so that the starting panels are suitable for shunt, series or compound motors. All contacts on sizes over 1¼ hp, either 110 volts or 220 volts, are renewable from the front without disturbing any connection. In all sizes the initial contacts are protected from burning by a quick-break arcing tip on the front of the panel, or by a blow-out coil on the rear, which prevents burning the contact on opening the circuit.

The question of whether a panel with circuit-breaker or switch and fuses is preferable cannot be answered definitely to apply to all installations, since each has its advantages and hence its own particular field. If fuses and circuit-breakers are rated to open the circuit at a certain current, the breaker will positively open the circuit as soon as the current reaches that value, even though the current remains at this high point only a very short time, while the fuse will carry currents in excess of its capacity for brief intervals. For this reason fuses may be preferable for motors that are liable to very brief overloads, especially where expert supervision of the electrical apparatus is maintained, such as in large mills and factories.

New Portable Testing Set for Watt-Hour Meters.

While the meter departments of electric-light companies are generally equipped with modern testing instruments of the indicating or portable rotating standard types, little attention has been given to a quick, economical method of loading meters in place, large quantities of energy being used at times in lamp-bank loads, etc. The portable testing set illustrated herewith and made by the Mohawk Electric Company, of Albany, N. Y., is claimed to offer numerous advantages over the older methods employed. The apparatus can be used only on alternating-current circuits, and while the set is particularly applicable to testing meters of the induction type, all types of direct-current meters can also be tested where alternating current is available for this purpose. By using a transformer of special design

TESTING SET FOR WATT-HOUR METERS.

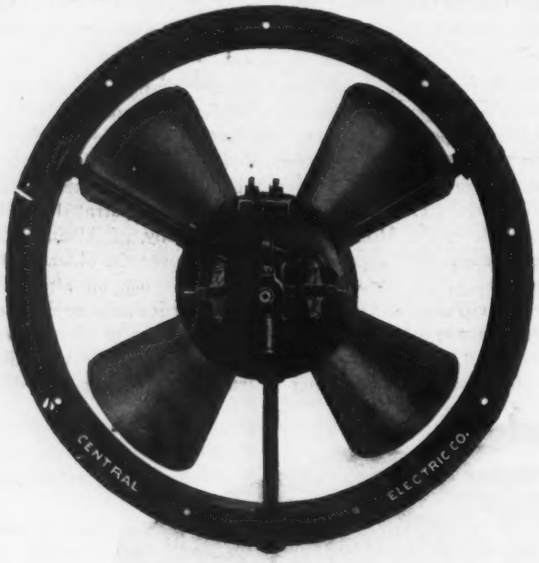
and employing non-inductive resistance units for control, no appreciable errors are introduced. The connecting terminals and plug switches are all plainly marked, and by the use of but four snap switches and an adjustable rheostat, any desired load can be instantly obtained. Provision is made also for testing other apparatus, such as a large number of lamps for wattage rating, etc. The sets are made for 5, 15, 25, 50, 75, 100 and 200 amp on 110-volt circuits, and weigh about 16 lb.

Modern Ventilation.

To meet the demand for a reasonably priced ventilating device, the Central Electric Company, Chicago, Ill., is marketing the fan shown in the accompanying illustration and which is particularly adapted to use in hotels, cafés, restaurants, saloons, stores, bakeries, halls, theaters, churches and billiard parlors where the ventilating fan is an absolute necessity in order to

properly serve the convenience of the public. In other places it also serves not only as a means of ventilation, but for removing dust, dirt, vapors, odors, etc., as in kitchens, boiler and engine-rooms, laundries, lavatories, candy factories, machine shops, mechanical works, breweries, textile mills, cold-storage houses, rubber factories, newspaper offices, starch factories, paper mills, packing houses, tobacco factories, etc.

This fan is made in both direct-current and alternating-current types, is 12-in. or 16-in. in diameter and embodies the latest improvements in motor design, all the parts being perfectly balanced and mounted in improved bearings, thus insuring minimum attention and noiseless operation. Particular attention has been given to the design of the supporting frame and a construction secured which is not only simple and strong, but one which is easily installed or removed. The motor bodies and supporting frames are finished in dull black marine, the blades, brush holders and oil cups being finished in polished lacquered brass, thus securing a combination which is durable and



VENTILATING FAN.

pleasing in appearance. The motors are wound for use on 100-125-volt or 200-300-volt circuits. The alternating-current fan is wound for 25-cycle, 30-cycle, 40-cycle, 60-cycle, 125-cycle or 133-cycle circuits, thus giving a very wide range of application.

Special Transmission Line Towers.

Energy for operating the Syracuse, Lake Shore & Northern Railway, which extends from Syracuse to Fulton, N. Y., is obtained from the generating station of the Ontario Power Company at Niagara Falls. The energy is transmitted over 60,000-volt circuits to a transformer substation in Syracuse where the e.m.f. is changed to 33,000 volts for further transmission to railway substations along the route of the above-mentioned railway. The 33,000-volt, three-phase transmission line crosses the Seneca River at Baldwinsville and the Oswego River at Phœnix. At each of these places it has been necessary to erect special transmission towers for carrying the line across the river. The span at the former place is 900 ft. in length, while that at the latter is 700 ft. A view of one of the spans is shown in Fig. 1, a side view of one of the supporting poles being given in Fig. 2. The tower measures 55 ft. in height to the lowest insulator, the other insulators being placed vertically 5 ft. apart and separated by 9 ft. horizontally. Each of the six cables was erected with a stress of 3300 lb., but the towers have been designed for an estimated maximum strain of 8000 lb. for the highest wind velocity when the cables are covered with sleet.

The cable is attached by means of clamps to a saddle which rests on and is supported by six porcelain insulators mounted on wrought-iron pins. For transferring the strain of the cables to the insulators use is made of a 1-in. steel pin so placed on the saddle that there is no twisting moment on the insulators. In case repairs become necessary any one insulator may be removed without disturbing the other five, which continue to support and insulate the cable from the tower.

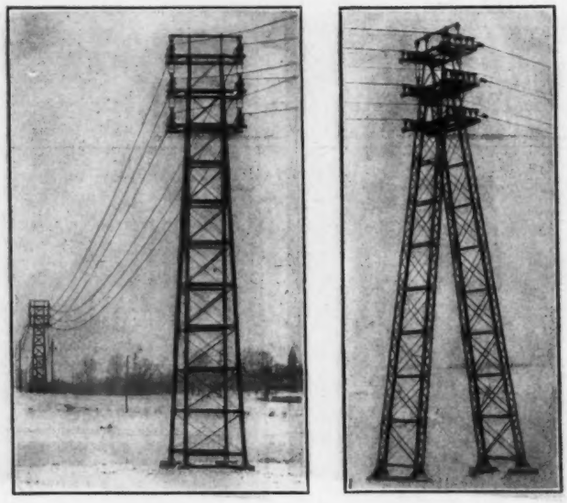


FIG. 1.—TOWERS FOR SPAN ACROSS THE OSWEGO RIVER. FIG. 2.—SIDE VIEW OF TOWERS SHOWING ARRANGEMENT OF INSULATORS.

Each tower is built in two parts resembling ladders. These parts are erected separately and bolted together in their final resting-places. These towers were designed and built by the Archbold-Brady Company, Syracuse, N. Y.

Weather-Proof Tungsten Cluster.

The Benjamin Electric Manufacturing Company, Chicago, is placing on the market the tungsten substitute for arc lamps shown in the accompanying illustration. As will be seen, it has a porcelain-enameled steel reflector and glass globe, the former being 20 in. in diameter and the latter 12 in. Above the former is a body portion of copper, metal cross-arms with porcelain knobs, weatherproof porcelain connecting block and suspension loop. The globe may be suspended and held in position for cleaning and removing lamps, or may be entirely removed if desired. This is accomplished by means of a rod passing through the hollow support. The fixture is ventilated at the top and bottom through holes small enough to keep out insects. An inside reflector of white-enameled steel, with openings for the lamps, assists in the radiation of light, this and

WEATHER-PROOF TUNGSTEN CLUSTER.

the main reflector being low enough to secure a good distribution of the horizontal rays in a downward direction. The fixture is furnished without the upper portion for attachment to a gooseneck or other form of suspension, where the wires are concealed. It is made for four and five lights and is suitable for up to 100 watts.

Retail Branch of Buckeye Electric Company.

Because of the fact that the Cleveland Electric Illuminating Company, of Cleveland, Ohio, discontinued the sale of lamps of all kinds on May 1, the Buckeye Electric Company, in order to secure its share of the business thus released, has opened a handsome display and salesroom in connection with its general offices in the Cuyahoga Building, that city. This is a novel departure from the usual policy of manufacturers and the result will be watched with interest. The central-station sales aggregated about 250,000 lamps per year, and, of course, there is a desire on the part of all concerns handling lamps to secure as much of the business as possible. The management of the Buckeye Electric Company felt that the opportunity for securing a good proportion of the business would be much better if it could have a display-room, where both large and small users might see the lamps in use and judge of their fitness for the purposes desired. Heretofore only large jobs have been handled direct, but now all business will be taken care of by the office or its agencies.

The stockroom, opening directly into the lobby, has been fitted up to carry 4000 lamps at all times. On the wall 30 lamps have been arranged on brass bars for display and sample work. They range from 8-cp carbons to 250-watt tungstens, with tantalums and other kinds that may be desired. Reflectors are also carried in stock, so that the full outfit may be sold over the counter. These sales are usually for cash, but credit is extended in case the purchaser is shown to be good by the ratings of the retail credit men's association.

Twenty-five agencies have been established in various parts of the city which carry in stock 8-cp and 16-cp carbon and 40-watt, 60-watt and 100-watt tungsten lamps, of the voltage furnished by the company in the sections of the city where they are located. These adjuncts to the central salesroom have proved very valuable so far.

After opening the salesroom the company entered upon a campaign of newspaper publicity, using large space with attractive cuts and arguments for its product. Not only was the sales and display-room advertised, together with the fact that any quantities of lamps could be purchased direct, but the agencies, with their locations, were named. The cost of this publicity was no small factor in the business, but the results have fully justified the expenditure. While the space used is not so large now as at the beginning, the advertising is continued in attractive form and will be kept up in order to maintain interest constantly in the plan that has been adopted.

All lamps sold over the counter and by the agents command the long price. No attempt has been made to undersell any one else or to offer prices or terms that are better than if the product was handled by retail stores. The entire argument is for the quality of the lamps and the kind of service that is furnished. For instance, the company gets 20 cents each for carbon lamps, while some others are offered at smaller figures. The business is being built up upon a substantial basis that will insure permanency.

Mr. L. P. Sawyer, secretary and treasurer of the company, states that the people of Cleveland are growing better acquainted with tungsten lamps than any other city in the country and that they are appreciated for their high quality and illuminating power. During the first three months of the year the sales of this kind of lamp increased 100 per cent over any like period previous to that time. Almost the entire increase in the business of the company has been in tungsten and tantalum lamps. Carbon-lamp sales have just about held their own.

In its campaign for business the company makes it a practice to replace arc lamps rather than any other kind of incandescent lamps. This plan is more satisfactory to all central-station managers, from the fact that there is no investment nor maintenance expense on their part. General satisfaction has been secured from this policy and no change is in contemplation.

Special men are employed to work with the agents and keep up their interest in the sale of lamps. The agents are usually men engaged in some other line of business, drugs, stationery, grocery or something of the kind. Many persons come into their places of business and they have an opportunity of talking lamps to them. This system has been found satisfactory for the residence business, but, of course, on the large orders men adapted to that kind of work are sent out. The company has built up a good business in both branches and through its publicity and hustling staff of salesmen expects to make the local sales second to none in the country.

The Westinghouse Electric Toaster-Stove.

An ideal electric combination cooking appliance for table use is embodied in the design of the new Westinghouse electric toaster-stove, which is not only a satisfactory electric toaster, but is available, by the simple substitution of a suitable top, as an electric stove for cooking a variety of dishes. The entire outfit is of artistic form and is finely finished in nickel steel, being designed for use at the table, where toast, cakes, muffins, scrambled eggs and a dozen other breakfast dishes may be served piping hot, prepared by this quickest, simplest and nicest method of modern cooking.

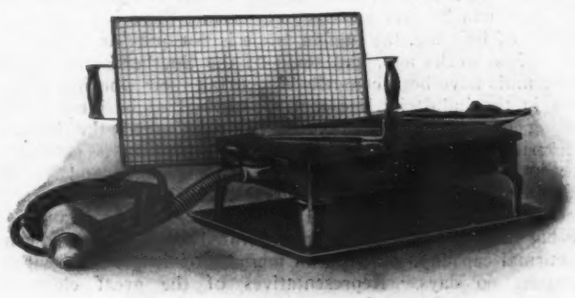


FIG. 1.—ELECTRIC TOASTER.

The construction of the toaster-stove may be readily seen from the accompanying illustration (Fig. 1). For toasting, the heater surface is covered with a wire grid, and the uniform toasting heat impinged on the bread insures delicious, evenly browned toast. Used as a cooker, the steel top replaces the wire tray, providing a hot surface for any ordinary cooking operation. If necessary, the steel top may be inverted, turning up a narrow rim which serves to retain fluids on the hot plate. The toaster-stove handle can be removed and used as a pancake turner. The toaster-stove will heat water in an extremely short time and makes an admirable hot plate for keeping food warm. It cannot overheat or burn out, even if left in circuit continuously. The toaster-stove measures 7 in. x 11 in. and weighs 5 lb. It is furnished complete with heater, toasting grid, cooking tray, detachable cord connection, and crumb tray. The heating element is of the well-known Westinghouse type, and is practically indestructible. The toaster-stove consumes 500 watts, and is made available for any voltage between 100 and 125.

FIG. 2.—ELECTRIC TOASTER.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The actual condition of commercial business was very little improved last week, but there was a considerable betterment noted in all industrial lines, and the general tone of business men was very much more cheerful. Weather conditions have been more favorable throughout the West and Southwest and planting has advanced more rapidly. It is practically conceded, however, that the wheat crop this season will be considerably short of what it was last year. The wholesalers and jobbers report that they are receiving orders only for filling-in purposes, but as even in the best of years this is an off season, these reports cause no astonishment. Retail business is only fair, but there is a general feeling in all branches that the fall trade will be very satisfactory. While there is an unusual amount of building, the lumber trade is not quite as brisk as it was a few weeks ago, and some of the Southern and Pacific Coast mills have been compelled to curtail their working hours. It is in the industrial line that the revival of business is becoming most marked. Reports from many of the leading industries show very satisfactory returns. This is especially true in the iron and steel products and in woolen and leather manufacturing. W. E. Corey, president of the United States Steel Corporation, announced last week that the plants of the big concern were now being operated at about 70 per cent of normal capacity, which is an increase of 10 per cent within the past 60 days. Representatives of the great electrical companies say that orders are being received in very much better volume and that if the improvement continues in the present ratio 1909 will probably equal 1907. The American Steel & Wire Company claims that within the past two weeks orders have been received in record-breaking volume and at times have run as high as 20,000 tons a single day. The United States Cast Iron Pipe & Foundry Company is operating at about 85 per cent of normal and has every prospect of reaching full capacity in the early fall. The International Harvester Company is practically running full time. The United States Rubber Company reports that it has sufficient business upon its books to keep its plant in steady operation for the rest of the year. All of these things indicate that the industrial tide has turned. The earnings of the railroad companies continue to grow, gross earnings are considerably in advance of a year ago and net earnings are in most instances the best in the histories of the roads. Collections continue to be rather slow but there seems to be little disposition on the part of creditors to use strenuous methods. Business failures for the week ended May 13 were 224, against 214 in the previous week, 281 in the same week of 1908, 184 in 1907, 161 in 1906 and 191 in 1905.

THE COPPER MARKET.

There has been very much more real strength and activity in the copper market during the past week than has shown up at any time within recent months. It was very generally understood that the rush of sales in March, which were largely advertised by the copper producers as evidence of returning interest, were in fact mostly speculative and really counted for little. The present condition is different and prices have been strengthened not on account of speculative buying but because it is apparent that there is an improved demand for the finished products in which copper plays a part. Wire, sheets, plates and castings are all in better demand and the manufacturers of electrical goods are better employed. All manufacturers have bought more liberally and there have been inquiries for some round lots for future delivery—a class of business which the producers do not at the present time seem inclined to encourage. The fact that consumers are anxious to buy has advanced prices for both lake and electrolytic to above 13 cents, with the prospect that a still further advance will be logical in the near future. For the first time in many months the consumers seem to be willing to purchase in advance of actual requirements. Heretofore they have been willing to allow the burden of carrying surplus copper to rest upon the producers, and have only bought to fill orders already taken. There is a disposition now to anticipate future business and this in reality is one of the most hopeful signs of the times. Among some of the statisticians of the copper market it is calculated that the consumers now have on hand a very liberal supply. These calculators figure that, according to the producers' returns, the consumers have taken 189,000,000 lb. since Jan. 1, and that in the same period they have used less than 130,000,000 lb., leaving in their hands at least 60,000,000 lb. This would mean a stock sufficient for a month and a half of normal business. Such figures, however, do not agree with present anxiety of the consumers to purchase. There is no doubt that American takings in May will be the heaviest of the year, that the exports will continue to be large and that consequently, in spite of the heavy production, there may be no addition to the surplus stock on June 1. Quotations on the Metal Exchange May 17 were:

Lake	13½ @ 13⅝
Electrolytic	12¾ @ 13
Casting	12⅝ @ 12⅞

The London prices May 17 were as follows:

	Noon. £ s d	Close. £ s d
Standard copper spot	50 7 6	59 8 9
Standard copper, future	60 1 3	60 2 6
Market	Easy.	Steady.
Sales of spot		400 tons
Sales of futures		800 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	.....	.....
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Casting	14.12½	12.00
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 10 0
London, best selected	67 15 0	59 0 0

ELECTRIC WEIGHING MACHINES FOR SUGAR IMPORTS.—Since the exposure of the irregularities in the weighing of raw sugar imports by the customs weighers and inspectors, the Government officials have determined to put into service automatic devices for this purpose. This is in line with plans that Gen. James S. Clarkson, Surveyor of the Port, has long been preparing. An automatic weighing machine that would record on a dial and which could not be tampered with was what General Clarkson wanted. He gave his ideas to Frank Davis, a Government employee with mechanical training, for development, and it is now believed that a machine that will answer the purpose has been designed. Mr. Davis did all his work at the United States Mint in Philadelphia, where the sample machine was built and tried. The plans have been kept secret ever since and the Government owns all the rights to the machine, although Mr. Davis, the nominal inventor, will derive a small royalty from them when they are actually placed in service. Bids have been asked for 20 of these machines, manufactured on the Government's plans, and the proposals will be opened at the Treasury Department, in Washington, May 20. The scales, so it was stated at the Custom House, have been thoroughly tested both here and in Washington and have finally been brought to a state of perfection where all objections have been overcome. They are electrically operated and automatically register the weights upon a scale protected by a glass case so it cannot be tampered with. The inspectors have keys to the machines for the purpose of taking out the records, but the machine will not operate when unlocked. It is proposed by the Government officials eventually to perfect the machines so that they will automatically register on tapes in the Surveyor's office as well as upon the tape in the machine. At the present time, however, this attachment is not contemplated. The machines have never been commercially manufactured and the bids are asked on the Government's specifications.

ELECTRO-MECHANICAL ENGINEERING BUREAU has opened offices in the Monadnock Block, Chicago, for consultation, inspection and tests along mechanical, electrical and chemical lines. The bureau will give expert attention to any technical subject, including the development and design of devices, processes and patentable ideas.

AMERICAN ELECTRICAL MACHINERY FOR JAPAN.—Takata & Company, 60 Wall Street, have recently placed a number of important orders for American electrical machinery for shipment to Japan, as follows: For Yokkaichi Electric Light Company—One 750-kw, 2300-volt, 60-cycle Westinghouse steam turbine outfit, including exciter; a 9-panel Westinghouse switchboard for the main station; a 5-panel switchboard for the transformer station; a 3-panel switchboard for the Kuwana substation; three Westinghouse 11,000-2200-volt step-up transformers; three 75-kw step-down transformers of the same type; eight 35-kw, 11,000-2200-volt transformers and a complete equipment of lightning arresters and spark gaps for both high voltage and low-voltage circuits. For the mechanical equipment there have been ordered three 326-hp Heine boilers; a Knowles surface condenser of 3000 sq. ft. cooling surface, with a double-acting air and circulation pump; a Knowles vertical triplex pump, to be driven by a Westinghouse 16-hp induction motor, and a Knowles plunger feed pump. For the Sapporo Water Power Electric Company the following apparatus has been ordered: From S. Morgan Smith & Company, York, Pa., a 650-hp McCormick horizontal turbine to operate under a head of 120 ft., which will be controlled by a Lombard type D governor; from the Westinghouse Company, a 400-kw, 3-phase, 11,000-volt, 60-cycle alternator, with a motor-generator exciter set; a power station switchboard to form a continuation of the present switchboard; a 3-panel substation switchboard; four 11,000-2200-volt, 150-kw step-down transformers, and three 20-kw step-down transformers for the substation. For the Tsuyama Electric Company an order has been given to S. Morgan Smith & Company for a 500-hp McCormick turbine to operate under a head of 88 ft., and to be direct coupled to a 300-kw alternator; for the same plant, a Lombard governor to control the above turbine; a 10-kw, 125-volt Westinghouse compound-wound exciter and a complete Westinghouse switchboard equipment for the above apparatus. For the Kanegafuchi Spinning Company for its Hiogo plant, a 1500-hp, 2300-volt Westinghouse steam turbine unit, together with an exciter, and also a motor-generator exciter set; two 50-kw, 60-cycle Westinghouse transformers; a Knowles condensing plant, consisting of a condenser of 3500 sq. ft. of cooling surface; a triplex air pump and a centrifugal circulation pump, the pumps to be driven by a 15-hp and a 20-hp Westinghouse induction motor, respectively.

FIGHTING THE PROPOSED CARBON TARIFF.—The dealers in flaming arc lamps are striving to head off the increase in the tariff on lighting carbons that is proposed by the Senate bill. The organization of dealers that was formed some weeks ago has employed George H. Mann, an attorney with offices at 60 Wall Street, to represent them before the committee. In speaking of the matter one of the importers said that he was confident the committee was working under a misapprehension of the facts and that it did not understand the trick in the bill through the insertion of the word "feet." He had seen the figures that the committee was using as its basis, and from these he thought erroneous conclusions were reached. "Taking the figures of 1907, in which the imports were 8,179,290 carbons valued at $157,311," he said, "the duty paid was $73,613, or 46.79 per cent ad valorem. The committee concludes that under the proposed bill this same lot of carbons would pay a duty of $57,253, or 39.39 per cent ad valorem. This would be true if the carbons imported that year has paid the full rate of 90 cents per 100. This was avoided, however, by importing in double lengths. The average length of the carbons imported in that year was probably 24 in., so that the 8,179,290 carbons probably measured 16,358,580 ft. and under the new law would pay a duty of $114,510, or about 73 per cent ad valorem. The senators do not understand that this would be the result of inserting the word 'feet.' Senator Smoot introduced an amendment last week which reduced the rate on the higher grades of carbons to 65 cents per 100 ft. and on the ordinary coke carbons to 35 cents. As there are none of the latter carbons imported and never will be even if there were no duty, this concession means nothing to the users of carbons." The fact that the matter has attracted some attention and that some of the senators are interested is considered by the importers to be a hopeful sign. The importers are leaving no stone unturned to fully acquaint the members of Congress with the facts about the carbon business.

AT WORK ON PENNSYLVANIA'S CABLE ORDER.—The Standard Underground Cable Company has already begun work on the big order for lead covered transmission cable for the Pennsylvania Railroad terminal. The entire work is expected to be completed and the cable delivered within six months. There will be about 100,000 ft. of the heavy cable which will be laid in the conduits already prepared and will extend from the Hackensack Meadows to the Long Island City power house. The cables will each carry three conductors, paper insulated and lead covered. The total cost to the railroad will be about $250,000 and the installation will be made as soon as the cable is delivered. The conductors will be 250,000 circ. mils and will carry a current of 11,000 volts, which will be stepped down to 650 volts before reaching the service wires.

UTILIZATION OF PEAT.—The Peat Engineering Company, with offices in St. Clair Building, Toledo, Ohio, has been formed to further the development of a peat industry in this country. The members of the firm are Messrs. Ernest V. Moore, Herbert Garnett and Francis J. Bulask. Mr. Moore is an honor graduate of McGill University and has received the Gowski gold medal for original peat research. Mr. Garnett organized and was general manager of the Irish Peat Development Company, the largest peat concern in Ireland, and has been a peat expert for the United States Department of Agriculture. Mr. Bulask has installed a number of peat utilization plants. The new firm will make analyses, supply drawings, contract for, erect and, if desired, operate for a period peat plants.

INTERNATIONAL STEAM PUMP COMPANY PROSPEROUS.—The annual report of the International Steam Pump Company for the year ended March 31, 1909, showed a balance for dividends of $1,064,000, which compared with $1,223,545 in the previous year. The amount added to the surplus was $204,200. The net profits were comparatively very much heavier than the gross earnings, which is explained by President Guggenheim by the fact that rigid economies had been practised in the manufacturing end. The gross business was but 60 per cent of last year, while the net profits were 92 per cent.

ALLIS-CHALMERS SALES.—We are informed by the Allis-Chalmers Company that it has during the past 90 days taken contracts for upward of 30 steam turbines and generators, aggregating in capacity nearly 50,000 kw and that negotiations are now pending for more than double that number. Among the orders recently placed is one for a unit of 2000 kw for the Public Service Corporation of New Jersey, to be installed at Camden, another of 2000 kw purchased by the Stone & Webster Engineering Corporation for the El Paso Electric Railway Company, El Paso, Tex., and a 2000-kw machine to be placed on a "repeat" order in the public service station of the city of Columbus, Ohio.

MINERALLAC ELECTRIC COMPANY, Monadnock Building, Chicago, has been incorporated to take over the business of the old Minerallac Company and the Chicago Electric Meter Company. The officers are as follows: President, L. A. Ferguson; vice-president, P. Junkersfeld; secretary, G. A. Freeman; treasurer, J. H. Goehst. The company will manufacture and sell the Chicago printing attachment to integrating wattmeters, high-tension insulating compounds, voltmeter switches, reverse-current relays, speed-limit devices, cable cleats and bushings and other specialties. With increased capitalization and an attractive and varied output, it is expected that the new company will do a flourishing business.

STATION APPARATUS WANTED.—The Chickasha Light, Heat & Power Company, Chickasha, Okla., writes that it will commence within three weeks the reconstruction of its plant, and is in the market for boilers, steam turbo-generators, condensing apparatus, pole line material and switchboards. It will operate 2300 volts, 60-cycle, three-phase. C. G. Johnson is superintendent of the work.

COAL BRIQUETTING.—Roberts & Schaefer Company, Old Colony Building, Chicago, has just closed a contract to build a briquetting plant in Kansas City, which will be in operation by August 1. C. T. Malcolmson, the electrical and mechanical engineer, who was connected with the Government fuel testing plants at St. Louis and Jamestown, is now associated with the Roberts & Schaefer interests, which have taken up coal briquetting in a very thorough manner, believing that the industry here should be comparable in extent with that already developed in Europe.

WILL BE NO SMELTING AGREEMENT.—John D. Ryan, president of the International Smelting & Refining Company, declares emphatically that there will be no rate agreement

between the new concern and the American Smelting & Refining Company. "Our company will be competitive in every sense of the word," said Mr. Ryan, "and we are going after the business in any district where we think we can get it." Mr. Ryan said that the new plant of the International Company at Tooele, Utah, which is 35 miles from Salt Lake City, will go into commission by Jan. 1, 1910. The plant at Perth Amboy, N. J., is operating at about full capacity.

RECENT ORDERS OF CROCKER-WHEELER COMPANY.—Recent orders booked by the Crocker-Wheeler Company include two 1000-kva, 6600-volt, three-phase, 25-cycle alternating-current generators for the Nordberg Manufacturing Company, Milwaukee, to be used for supplying light and power to the Miami Copper Company, Globe, Ariz. The Houston, Tex., Electric Company, Houston, has purchased an 800-kw, 575-volt direct-current generator. Two three-phase, 2300-volt, 50-cycle alternators, having a combined capacity of 550 kva, are to be added to the equipment of the municipal plant at Pasadena, Cal. A motor-generator set consisting of a three-phase, 60-cycle, 2300-volt, synchronous motor and a 300-kw, 575-volt direct-current dynamo was sold to the Boise Valley Railway Company, Boise, Idaho. An order from Charles Wouter, Chicago, calls for a 100-kw generator with a range in potential of from 125 to 250 volts, and a similar order from the Timken Detroit Axle Company, Detroit, Mich., is for a 100-kw, 250-volt, direct-current generator. A Form W motor, having a capacity of 200 hp, built for 230 volts, was shipped to the Hunt Engineering Company at Des Moines, Iowa. This motor is series wound and will be used in operating a derrick. Two 100-hp, 3-phase, 60-cycle induction motors of the wound rotor type, rated at 100 hp each, were billed to the Boston & Corbin Copper & Silver Mining Company, 82 Devonshire Street, Boston. The National Tube Company, McKeesport, Pa., has added to its 22,800 hp of Crocker-Wheeler motors to the extent of 275 hp for the operation of rolling mill machinery, etc.

ALUMINUM.—The manufacturers of aluminum in this country report that there is not a great amount of business being done at the present time, although some aluminum transmission wire is being sold, and from the number of inquiries that are being received it is evident that electrical companies are taking more interest in the use of aluminum for transmission purposes. Although the principal patents under which the Aluminum Company of America has been operating have expired and the field is now practically open, there has not as yet been any definite announcement made of rival concerns entering the business. Aluminum continues to be quoted at from 20 to 23 cents per pound, and it is not believed that the proposed reduction of 1 cent in the present tariff rate will have any material effect upon the price.

INTERBOROUGH WILL BUY EQUIPMENT.—Specifications have been prepared and bids asked by the Interborough Rapid Transit Company, of New York City, for 150 steel cars for the subway division and 100 cars for the elevated roads. So far bids have not been asked for the motor equipment of these cars, but it is understood that specifications are being prepared. The cars of the Interborough now in service are provided with two motor equipments, each motor being of about 200 hp. Heretofore these motor equipments have been fairly evenly divided between the General Electric and the Westinghouse. As the contract for the cars has not yet been let, it is not likely that bids will be asked for the electrical equipment in the near future.

Financial Intelligence.

THE WEEK IN WALL STREET.

The past week on the New York Stock Exchange was one of some activity and considerable strength in prices. It is true that whenever there occurred an advance of more than a few points that the profit-takers showed up and prices were apt to recede under their selling, but on the whole the stock market shows the effect of the bettered condition in commercial and industrial affairs. The reports from all industrial centers bring tidings that the tide has turned and that business has at last taken that change for the better that has so long been looked for. The reports from the railroads show vastly increased earnings; the commercial conditions, while nothing to boast of, are more satisfactory than a month ago; the crops have had some growing weather and the money market is remarkably easy. Even the tariff bugaboo seems to alarm Wall Street no longer. It seems to be very thoroughly understood that there will not be such a revision of the tariff as to hurt any manufacturing interests. It is even believed that there is an end of the debate in sight. The greatly improved condition of the steel trade has done much to help along. The mills are all busy and even if the orders have been taken at rates much lower than last year, they were not taken at a profitless rate and the plants will be kept busy. While there were no especial developments during the week it is evident that the railroads are preparing to buy equipment. In fact a number of small orders have been placed and inquiries for much larger ones have been made. There is no secret about the fact that the roads need cars, locomotives and rails. When the managers of these properties are satisfied that it is safe to branch out there will probably be such a rush of orders that all plants will be working overtime. While this perfectly satisfactory condition of affairs is prevailing at home the foreign markets are showing equal improvement. American securities are strong in London and the foreigners buy on every price recession. The improved tone of the copper metal market has done much to strengthen the prices of the copper stocks. Amalgamated, which is of course the leader of the market, has been conspicuously strong and there is already talk of an increase in the dividend. The shares of the electrical companies have shown considerable strength and both General Electric and Westinghouse were active and strong on May 17, which is the last day under review. The bond market continues to be very strong and every issue that is offered is subscribed without any trouble. The banks are still well supplied with cash and rates are cheap, in spite of the fact that there were heavy takings of gold for Europe during the week. On May 17 call money was quoted at 1¾ @ 2 per cent, 90 days 2½ @ 2¾ per cent. The quotations in the table are those of the close, May 17.

NEW YORK.

	May 10.	May 17.	Shares Sold.		May 10.	May 17.	Shares Sold.
All.-Ch.	15½	16	1,520	Int.-Met.,.pfd.	46½	44½	22,700
All.-Ch., pfd.	50⅜	51½	9,300	Mackay Cos.	78½	79½	2,600
Amal. Cop.	82⅛	82¾	131,175	Mackay Cos.,pfd.	73*	73½	1,100
Am. D. T.	29*	29*	——	Manhattan Elev.	146½	147	1,550
Am. Loc.	57½	56⅜	8,900	Met. St. Ry.	30	30*	100
Am. Loc., pfd.	115½	115	1,000	N.Y. & N.J.Tel.	123*	123*	——
Am. Tel. & Cbl.	76*	77¾*	50	Steel, com.	57⅛	56⅜	413,355
Am. T. & T.	140¾	139⅞	12,600	Steel, pfd.	119	118¾	18,928
B. R. T.	79½	78⅞	58,550	W. U. T.	75¾	76	6,600
Gen. Elec.	159	160	6,235	West'h., com.	83⅜	84¼	5,350
Int.-Met., com.	16⅜	16¼	15,920	West'h., pfd.	120*	120	——

PHILADELPHIA.

	May 10.	May 17.	Shares Sold.		May 10.	May 17.	Shares Sold.
Am. Rys.	45½	45¾	——	Phila. Elec.	12	12⅜	——
Elec. Co. of A.	12⅜*	12½	——	Phila. R. T.	33¼	34⅜	——
Elec. Stor. B'ty.	48¼	48⅜	——	Phila. Traction.	93*	92½*	——
E. S. B'ty, pfd.	49*	49*	——	Union Traction.	56¾	56¼	——

CHICAGO.

	May 10.	May 17.	Shares Sold.		May 10.	May 17.	Shares Sold.
Chi. City Ry.	180*	180*	——	Chi. Tel. Co.	133	134	——
Chi. Rys., Ser.1.	109½	109½*	——	Met. El., com.	19*	19*	——
Chi. Rys., Ser.2.	38½*	38½	——	Nat'nal Carbon.	84	85	——
Com. Edison.	115½	119	——	Nat. Carb., pfd.	118*	120*	——
Chi. Subways.	27¾	26½	——				

BOSTON.

	May 10.	May 17.	Shares Sold.		May 10.	May 17.	Shares Sold.
Am. Tel. & Tel.	140¾	140	——	Mex. Tel.	2½	2⅜*	——
Cum. Tel.	135*	138	——	Mex. Tel., pfd.	5½	5½*	——
Edison El. Ill.	250	250	——	N. E. Tel.	132	133½	——
Gen. Elec.	160	160⅞	——	W. Tel. & Tel.	12½	12	——
Mass. Elec. Ry.	13¾*	13½	——	W. T. & T., pfd	85	87	——
Mass. E. R., pfd	71	71	——				

*Last price quoted.
Shares sold are for week May 10 to May 15.

DIVIDENDS.

American Railways Company, quarterly, 1½ per cent, payable June 15.

Butte (Mont.) Electric & Power Company, quarterly, 1½ per cent, payable June 1.

Chicago Telephone Company, quarterly, 2 per cent, payable June 30.

Columbus (Ohio) Railway Company, quarterly, 1¼ per cent, payable June 1.

Grand Rapids Railway Company, quarterly, 1 per cent, payable June 1.

Kings County (N. Y.) Electric Light & Power Company, quarterly, 2 per cent, payable June 1.

Laclede Gas Light Company, St. Louis, preferred, semi-annual, 2½ per cent, common, quarterly, 1½ per cent, payable June 15.

Philadelphia Electric Company, semi-annual, 3 per cent, payable June 15.

St. Joseph, Mo., Railway, Light, Heat & Power Company, ½ per cent, payable June 1.

TOLEDO RAILWAYS & LIGHT COMPANY.—Plans are being perfected for the reorganization of the Toledo Railways & Light Company. During the past week, a stockholders' protective committee has been formed of which William E. Hutton is the chairman. A circular has been sent to all stockholders by this committee stating that the time has come when prompt and effective action must be taken and that it is necessary for the stockholders to co-operate directly with the creditors in a proper plan for refinancing. There is already in existence a bondholders' protective committee and it is with this committee that the stockholders desire to co-operate. The outstanding liabilities of the company are $12,421,960 and about half of this amount is either overdue or will become due July 1. It is said that public sentiment in Toledo is favorable to an extension of the expiring franchise, and if this is done, the company should be able to refund its indebtedness and to raise new capital for extensions and improvements.

HUDSON TUNNELS ALMOST READY.—Large signs have been posted on the Hudson Terminal buildings on Church Street in New York, announcing "On July 1, trains will run from this terminal; Pennsylvania railroad three minutes; Erie, six minutes; Lackawanna, ten minutes." Work upon the tunnels is being pushed rapidly with night and day forces and there is no doubt that they will be completed on the date set. The two upper tubes of the system are now handling passengers at the rate of 17,000,000 per year and it is estimated that when the lower tubes are in operation, the system will have a travel of about 80,000,000 passengers per year. It is figured out that on account of the low cost for operation and maintenance, the entire Hudson & Manhattan Railroad property will bring in a total net revenue of $1,000,000 above all interest and sinking fund requirements.

THIRD AVENUE RAILROAD SALE ORDERED.—The decree of foreclosure against the Third Avenue Railroad property, in New York, was ordered in the United States Court, May 17, and the date of sale set for Sept. 2. This judgment was entered in the suit of the Central Trust Company, acting as trustee for the $37,560,000, 4 per cent mortgage bonds, interest on which has been defaulted since July 1, 1907. The sale not only includes all the physical property of the company but all the securities which it held including the 20,000 shares of the Union Pacific Railroad Company, which turned up in the company's treasury. This is the first step in the reorganization of the company, and it is said the bondholders are preparing to protect their holdings.

SOUTHERN TELEPHONE COMPANY FOR SALE.—The Columbus (Ga.) Automatic Telephone Company has petitioned the City Council for permission to surrender its franchise and sell its physical assets to the Southern Bell Telephone & Telegraph Company. The company has been operating an exchange since 1903 and has about 900 subscribers. The company has not been a financial success, and it is said the bondholders would be obliged to foreclose unless the company's assets were sold and the debts paid. The Southern Bell Company agrees to pay $50,000 for the poles, conduits, wires, etc. This would give the bondholders about 40 cents on the dollar, but the stockholders would get nothing. The capital stock of the company is $130,000.

EXTRA DIVIDEND FOR UNITED METALS SELLING COMPANY.—The United Metals Selling Company has declared an extra dividend of 50 per cent which represents the disbursement of the cash received from the International Smelting & Refining Company for the plant at Perth Amboy, N. J. In addition to the $2,500,000 in cash received the United Metals company got between $3,500,000 and $4,000,000 in stock.

IOWA CITY CONSOLIDATION.—The Iowa City (Iowa) Electric Light Company and the Iowa City Gas Light Company have been combined under the title of Iowa City Gas & Electric Company. George S. Carson, who was president of both of the old companies, is the president of the consolidated enterprise. Mr. Carson, who is a former president of the Iowa Electrical Association, is one of the enterprising central-station men of Iowa, and he is confident that the new company will be stronger and better fitted to serve its customers than both of the old ones.

ELECTRIC STORAGE BATTERY COMPANY.—The stock of the Electric Storage Battery Company has recently been in considerable demand upon the Philadelphia exchange and there has been considerable improvement in prices. It is said that this demand is due to buying by insiders who are well acquainted with the company's business. A director of the company is responsible for the statement that orders have been coming in steadily within the past few months and that the outlook for increased earnings was never brighter than it is at present.

BROCKTON EDISON STOCK.—The Edison Electric Illuminating Company of Brockton has petitioned the Massachusetts Gas and Electric Light Commission for authority to issue 1600 additional shares of stock to pay for additions to the plant, the purchase of new property, and the purchase of the property of the Stoughton Gas & Electric Company. The Edison company has also petitioned the commission for permission to purchase the plant, franchise and business of the Bridgewater Electric Company.

WASHINGTON, BALTIMORE & ANNAPOLIS STOCK.—During the past week there was considerable activity in the stock of the Washington, Baltimore & Annapolis Electric Railway Company on the Cleveland Stock Exchange where the stock is frequently traded in. This was supposed to be occasioned by the announcement that the General Electric Company had purchased a large block of the bonds of the company. Several thousand shares changed hands at prices ranging from 5⅞ to 6⅛.

LACLEDE GAS LIGHT COMPANY DEAL.—The negotiations for the sale by the North American Company of the Laclede Gas Light Company, of St. Louis, to the American Light & Traction Company, have not been completed as yet, but there is no hitch in sight and the transfer will undoubtedly be made. Experts are now making an examination and appraisal of the property and until this is finished the deal cannot be completed.

REFINANCING BOSTON ILLUMINATING CONCERN.—The Edison Electric Illuminating Company has petitioned the Board of Gas and Electric Light Commissioners for an approval of an issue of $160,000 additional capital stock, the proceeds to be used to retire part of the floating debt and for acquisition of the Stoughton Gas & Electric Company. The company also asks for approval of the purchase of the Bridgewater company.

NEW YORK AIR BRAKE COMPANY INCREASES CAPITAL.—The New York Air Brake Company has filed with the Secretary of State of New Jersey an amendment to its certificate of incorporation increasing its capital stock from $10,000,000 to $13,000,000. The plants of the company have been greatly enlarged recently and the business has been very satisfactory.

PULLMAN ELECTRIC POWER PLANT.—The Pullman Company has started improvements on its plant at Pullman which involve an expenditure of $3,000,000. A power house costing $100,000 will be erected, which will contain an electrical equipment to develop 8,000 hp.

BONUS FOR CANADIAN BELL TELEPHONE SHAREHOLDERS.—As a result of the sale of its line in the province of Saskatchewan, it is promised that a bonus will be paid to the shareholders of the Bell Telephone Company of Canada.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Fonda, Johnstown & Gloversville Railroad Company:					
Quarter ended March 31, 1909	165,070	93,214	71,856	.....	*19,982
Quarter ended March 31, 1908	146,845	91,069	55,775	.....	*33,648
Lexington (Ky.) & Interurban Railway Company:					
March, 1909	40,957	34,703	6,254	.....	.....
March, 1908	43,985	31,380	12,605	.....	.....
Third Avenue Railroad Company:					
Quarter ended March 31, 1909	1,344,177	1,093,738	250,438	234,894	182,395
United Railways of St. Louis:					
April, 1909	911,654	569,702	341,952	233,527	108,425
April, 1908	865,691	570,663	295,028	232,274	62,754

*Deficit.

GENERAL NEWS

Construction News.

ANNISTON, ALA.—The Alabama Power Development Company is securing a right-of-way for a hydro-electric power transmission system between Anniston and Talladega, via Munford and Jackson Shoals.

DOTHAN, ALA.—The City Council has passed an ordinance to issue bonds for extensions and improvements to the municipal electric light plant.

FORT SMITH, ARK.—The Fort Smith Light & Traction Company, through H. M. Byllesby & Company, of Chicago, Ill., has purchased from John A. Stewart Electric Company, of Cincinnati, Ohio, the following electrical and steam equipment for its plant: One 1650-kw, 60-cycle, three-phase, revolving field, General Electric alternator, direct connected to a Hamilton-Corliss, cross-compound, heavy duty engine.

ROGERS, ARK.—Plans are being considered by the Rogers, Pea Ridge & Northern Interurban Railway Company for the construction of an electric railway which will connect Rogers and Pea Ridge, also Diamond and Electric Springs, for which preliminary survey has been made. The railway will be 20 miles in length, and it is expected that construction work will begin within 90 days. It is proposed to erect a power plant and repair shop in Rogers. A. R. Potter is president, and Bryan Snyder, secretary, both of Rogers.

FAIRFIELD, CAL.—The Board of Supervisors has granted the Randall, Trowbridge & Wright Company a franchise to construct an electric railway connecting Vallejo, Benicia & White Sulphur Springs. The price paid for the franchise was $100 and 2 per cent of the gross receipts of the company. The White Sulphur Springs property has been purchased by the company and will be improved for a summer resort.

GRIDLEY, CAL.—The city is reported to be considering the purchase of the electric light plant and franchises belonging to the estate of the late R. F. Beebe.

GUERNEVILLE, CAL.—The Snow Mountain Water & Power Company has awarded a contract to G. W. Nelson for the erection of a transmission line from the Fulton line of the company to Guerneville, a distance of 17.58 miles, for $300 per mile.

LOS ANGELES, CAL.—The Board of Public Works has awarded the contract for ornamental posts for lighting Fifth and Main Streets to Central Street to the Llewellyn Iron Works, for $100 per post.

LOS ANGELES, CAL.—Contracts have been awarded by the Pacific Electric Company for the construction of the electric railway connecting Delhi with Huntington Beach, a distance of 10 miles.

MODESTO, CAL.—The La Grange Light & Power Company is making arrangements to secure a site near Dry Creek bridge in this city on which it will erect its buildings. A. Scott is superintendent.

OAKLAND, CAL.—The City Council has granted the property owners along Telegraph Avenue from the junction of Sixteenth Street and Broadway to and including Twenty-second Street permission to erect electroliers between the streets named, the lamps to be maintained by the city.

SANTA ANA, CAL.—The Santa Ana Valley Irrigation Company has applied to the Board of Supervisors for a franchise to construct a transmission line up the Santa Ana Canyon to the county boundary for the purpose of furnishing electricity.

SELMA, CAL.—The Board of Trustees has granted the application of the local telephone company, allowing it to rebuild its system in the town, which will involve an expenditure of about $10,000.

SONORA, CAL.—Plans are being made to equip the Reiner mine to be operated by electricity, which will be furnished by the Tuolumne Water Power Company.

TRUCKEE, CAL.—It is reported that the Donner Ice Company contemplates installing an electric plant.

HARTFORD, CONN.—The House of Representatives has passed the bill granting amendments to the charter of the Connecticut River Company. The charter gives the company the right to widen and deepen the canal, to build a dam or dams across the Connecticut River between the towns of Windsor Locks and Enfield, or Enfield and Suffield, at any point above the present mills of the American Writing Paper Company at Windsor Locks and below the Enfield dam, and on either or both sides of King's Island, and to maintain all the appurtenances to the dam and power plant, and to generate and distribute electricity. The company proposes to build a new canal about two-thirds of a mile in length to connect the river channel near Windsor Locks with the pool above the dam. The present canal is about 75 ft. wide and only 10 ft. deep, while the proposed canal is to be 40 ft. wide and 20 ft. deep.

NEW BRITAIN, CONN.—Plans have been prepared by Landers, Frary & Clark for the construction of a large electric power plant to furnish electricity for operating and lighting their entire plant.

NEW HAVEN, CONN.—Arrangements are being made by the United Illuminating Company to place its wires underground on Grand Avenue from the power station at Mill River to the center of the city.

NORWICH, CONN.—The Uncas Power Company has applied to the State Legislature for an amendment to its charter giving it the privilege to supply electricity in any city or town in New London County where there are no power companies operating.

EUSTIS, FLA.—The Town Council has passed the ordinance granting a franchise for an electric light plant, and a contract has been made with Childs & Company for the installation of the plant, subject to a vote of the taxpayers.

JACKSONVILLE, FLA.—A. Metaner, of this city, has applied to the City Council for a franchise to install an automatic telephone system in Jacksonville.

LA BELLE, FLA.—E. E. Goodno is reported to be considering plans for the construction of a hydro-electric plant to furnish electricity for lamps and motors in La Belle.

LEESBURG, FLA.—The Senate has passed the bill authorizing the Town Council of Leesburg to establish an electric light plant and water-works system.

AMERICUS, GA.—The lighting committee of the City Council has accepted plans prepared by E. H. Davis, of Griffin, Ga., and contracts for construction of the plant will be awarded May 26. The plant will be erected and operated in connection with the municipal water works system. The cost of the plant is estimated at $20,000.

COLUMBUS, GA.—The Columbus Automatic Telephone Company has applied to the City Council for permission to surrender its franchise and sell its property to the Southern Bell Telephone & Telegraph Company. The Bell company agrees to pay the company $50,000 for its plant and system.

CORNELIA, GA.—A 30-year franchise has been granted to the Wofford Shoals Power & Light Company to furnish electricity for lamps and motors in Cornelia. J. Wells, of Atlanta, Ga., is interested in the enterprise.

HAMPTON, GA.—At an election held May 10 the citizens voted to issue $20,000 in bonds for the construction of an electric light plant and water-works system. W. M. Harris is chairman of committee.

WASHINGTON, GA.—The Washington Telephone Company contemplates making improvements to its system, which will involve an expenditure of about $5,000, and includes the erection of new poles and replacing open wires with cables.

GRANGEVILLE, IDAHO.—The Whitebird Telephone Company, recently organized, proposes to erect a mutual telephone line from Whitebird to Grangeville, a distance of 20 miles.

TWIN FALLS, IDAHO.—The City Council has granted George D. Aiken a franchise to construct an electric railway in Aiken.

WALLACE, IDAHO.—The Washington Water Power Company is making investigations in this city and in the Cœur d'Alene district with a view of extending its transmission lines to the smaller mines and prospects, including those on Sunset Peak, and between Mullan and Burke and also in the Murray district.

HAMBURG, ILL.—Plans are being made by the Merida Telephone Company to lay a cable across the Mississippi River and extend a telephone line from the west bank to Elsberry, Mo., to improve the long-distance service.

KANSAS, ILL.—It is reported that the Board of Trustees has decided to sell the municipal electric light plant. It is said that the plant will be sold for $4,000, the purchaser to pay for it by furnishing street lamps to the village for a term of seven years, making the cost of the service $700 per year.

MACKINAW, ILL.—The Illinois Traction Company has awarded contracts for the construction of a new power house and substation at Mackinaw, to cost $8,000. It is stated that plans are being drawn to rebuild the plant at Minier at a cost of about $8,000.

MASCONTAH, ILL.—Plans are being considered to construct an electric railway to connect Mascontah and Belleville. Captain Charles Hewitt and H. M. Needles, of Belleville, are reported to be interested in the project.

NORRIS, ILL.—The Peoria & Galesburg Railway Company has been granted a franchise to erect its proposed electric railway over certain streets in Norris.

NORTH CHICAGO, ILL.—The contract for installing an outside lighting system at the naval training station, North Chicago, has been awarded to the D'Olier Engineering Company, of Philadelphia, Pa., for $5,516.

ONARGA, ILL.—It is reported that the local telephone company contemplates rebuilding its system and installing new equipment.

ROCKFORD, ILL.—The plant and holdings of the Rockford & Interurban Company, operating the local street railway and electric interurban railways from Rockford to Janesville, Wis., and Belvidere and Freeport, Ill., was purchased May 11 by an Eastern syndicate. The

stockholders will receive par value on the common stock amounting to $1,000,000, and also on preferred stock amounting to $50,000. The new owners have assumed a bonded indebtedness of $2,725,000.

BLUFFTON, IND.—The Bluffton, Geneva & Celina Interurban Company has applied to the County Commissioners for a franchise to construct its railway over the county roads between this city and Adams County.

BLUFFTON, IND.—The W. B. Brown Chandelier Company is planning to erect an addition to its factory and to equip the plant to be operated by electricity.

COLUMBIA CITY, IND.—Arrangements are being made by the Whitley County Telephone Company for the reconstruction of its system in this city and to South Whitley. It is proposed to move the exchange to larger quarters and install a new switchboard and to place all wires in cables.

EVANSVILLE, IND.—Specifications are now being prepared by the Board of Works for the contract for lighting the streets of the city. Although the present contract for street lighting does not expire for more than a year, the Board proposes to give any company which wishes to compete with the Evansville Gas & Electric Light Company sufficient time to erect a plant in case they are awarded the contract.

FORT WAYNE, IND.—The Fort Wayne & Wabash Valley Traction Company has been awarded the contract for furnishing electricity for lamps and motors for the Federal Building for the year beginning July 1, 1909, at four cents per kw-hour, with no lamp renewal privileges. The bid of the municipal electric plant was eight cents per kw-hour with a decreasing scale depending upon the amount used.

INDIANAPOLIS, IND.—The commission appointed to construct and equip a tuberculosis hospital near Rockville will receive bids at Room 54, State House, Indianapolis, Ind., for the construction and installation of a power and light plant in connection with the hospital.

INDIANAPOLIS, IND.—Bids will be received by the trustees of the Indiana School for Girls, after June 1, for the construction of an addition and improvements to the power plant and for lighting the grounds of the school.

INDIANAPOLIS, IND.—Plans have practically been completed for making several of the streets in the downtown business district a "Great White Way." The plan involves changing all of the poles of the Indianapolis Traction & Terminal Company in the district and the substitution of larger and ornamental poles. It is proposed to install 10 arc lamps to each square. The new lamps will cost the city $74 each per year. It is expected that the street railway will pay part of the expense of rearranging the lighting system. The plan does not include all of the streets in the business district of the city at the present time.

SARATOGA, IND.—The Eastern Indiana Telephone Company has been granted a franchise to construct and operate a telephone system in Saratoga. The company will rebuild the local telephone exchange and new equipment will be installed. The head office of the company is located in Winchester, Ind.

UPLAND, IND.—The Town Board has granted a franchise to the Hartford City Electric Light Company to furnish electricity to light the town. The company will extend its transmission lines to Upland, a distance of eight miles. The company also operates at plant at Jonesboro, eight miles west of Upland, and it is proposed to connect Upland with Hartford City and Jonesboro.

BOONE, IA.—Contracts have been awarded by the Boone County Telephone Company for the construction of a new exchange building in Boone. The company proposes to erect an entire new plant this year at a cost of about $125,000.

DES MOINES, IA.—Arrangements are being made to install electroliers from West Twelfth Street to the capitol, on Locust Street, and on Walnut Street from Eighth Street to Twelfth Street. The merchants on Fourth Street have also contracted for cluster lamps.

MASON CITY, IA.—The Western Electric Telephone Company contemplates rebuilding its telephone line to Algona at a cost of several thousand dollars.

MITCHELLVILLE, IA.—The Rural & Four-City Telephone Company has been granted a franchise to construct and operate a telephone system in Mitchellville. Franchises have now been secured by the company in Prairie City, Altoona and Mitchellville.

REINBECK, IA.—The Traer Mutual Telephone Company contemplates the installation of a new switchboard and other improvements to its system.

EL DORADO, KAN.—Plans are being made by the El Dorado Motor & Machine Company for an addition to its plant, which will include the installation of a 6-hp gasoline engine and an electric plant to furnish electricity for charging storage batteries and operating its repair shops.

RUSTON, LA.—Extensive improvements are being made to the municipal electric light plant, which will include the installation of a 100-kw, two-phase, Westinghouse alternator and an automatic transformer for a 25 arc-lamp circuit. The generator replaces a direct-current dynamo and will be used in connection with a single-phase alternator, which heretofore has been used for incandescent lamps. The cost of the work is estimated at $2,500. E. S. Gray is superintendent.

BALTIMORE, MD.—Plans are being made by the Consolidated Gas, Electric Light & Power Company for making improvements to the Penn Street substation, which will involve an expenditure of about $7,000. F. C. Latrobe is president of the company.

BALTIMORE, MD.—Superintendent of Lamps and Lighting McCuen has given orders for additional goose-neck arc lamps to be erected on North Avenue between Oak and St. Paul Streets, and has also decided to extend the system of cluster lamps on North Avenue Bridge westward to Mount Royal Avenue.

BALTIMORE, MD.—Contracts have been awarded by the Board of Awards for conduits for the Subway Commission, as follows: To the Great Eastern Clay Company, New York, N. Y., 1,000,000 ft., for $60,000; the American Conduit Company, Chicago, Ill., and the Fiber Conduit Company, of Orangeburg, N. Y., 100,000 ft., for about $10,000.

BALTIMORE, MD.—The Consolidated Gas & Electric Company has submitted a proposition to the city of Baltimore to supply natural gas in the city. It is proposed to construct a pipe line from West Virginia, 230 miles in length, and to furnish natural gas at the following rates: For domestic lighting, 58 cents per 1000 cu. ft.; for cooking purposes, 45 cents, and for fuel and power, 40 cents. In return for the franchise the company offers to let the city choose five of the 18 members of the board of directors and to turn over 40 per cent of the company's income after all fixed charges and 4 per cent on common stock are paid. The work will require an initial expenditure of from $12,000,000 to $15,000,000.

BOSTON, MASS.—Bids will be received until June 12 at the U. S. Engineer Office, Boston, Mass., for electrical cable. For further information apply to Edward Burr, Lt.-Col., Corps of Engineers, U. S. A.

MALDEN, MASS.—The Malden Electric Company has been granted permission to construct an underground conduit system for its cables and wires. It is said that the company contemplates an expenditure of about $300,900 on the system within the next five years.

NORTH ANDOVER, MASS.—Plans have been completed by Charles T. Main, of Boston, Mass., mill architect and engineer, for a new power plant for W. T. Stevens & Sons Company, of North Andover. The plans include the construction of a power house, the equipment of which to include a 360-kw Westinghouse turbo-generator set with two exciters and a motor-driven Le Blanc condenser. The boiler room will be equipped with two horizontal return tubular, 72-in. Bigelow boilers with forced draft. Space is provided for duplicate boiler installation. The pump room will be equipped with boiler feed pump and a 1000-gal. fire pump. The stack is to be of brick 150 ft. high with a 6-ft. flue.

SHELBURNE FALLS, MASS.—It is reported that negotiations are under way between H. L. Harriman and associates of Boston, Mass., and the Lamson & Goodnow Manufacturing Company, of Shelburne Falls for the purchase of the water-power rights owned by the latter, at North River, where the company has a dam, and at Scott's bridge. The water rights owned by George G. Merrill were purchased a short time ago. It is said that if the plans are carried out the new owners will furnish power for operating the cutlery factory. Mr. Harriman is interested in the power development at Vernon, Vt.

WAKEFIELD, MASS.—The managers of the Wakefield electric light plant have made arrangements to secure electricity for day service from the municipal electric plant at Reading for a term of two years, with the privilege of renewal. For the past four years the town has purchased electrical energy for the day service from the Malden Electric Company at the rate of 3¾ cents per kw-hour. Under the new contract the price paid for the first 35,000 kw-hours is 2½ cents per kw-hour, and all used above that amount will cost two cents per kw-hour. The contract takes effect June 28.

WORCESTER, MASS.—It is reported that the Connecticut River Power & Transmission Company is planning to extend its transmission lines to Worcester to furnish electricity to the north works of the American Steel & Wire Company to operate the new electric furnaces now being installed.

ALPENA, MICH.—The Board of Supervisors has granted the Alpena Power Company permission to construct a cement and concrete dam across Thunder Bay River to replace the old dam known as the Richardson dam.

HARTWICK, MICH.—The capital stock of the Osceola Rural Telephone Company has been increased from $3,000 to $6,000.

HILLSDALE, MICH.—The proposition to issue $12,000 in bonds to enlarge the municipal electric light plant was defeated an an election held May 10.

BAUDETTE, MINN.—At an election held recently the citizens voted to issue $25,000 in bonds, the proceeds of $5,000 to be used for improvements to the municipal electric light plant.

MIDDLE RIVER, MINN.—Plans are being considered to erect a telephone line between Middle River and New Folden.

NASHWAUK, MINN.—The question of installing an electric light plant is under consideration by the City Council.

PINE CITY, MINN.—The Pine City Electric Power Company is reported to have awarded a contract to the Fort Wayne Electric Works, of Fort Wayne, Ind., for the installation of equipment for its power plant for $10,000.

ST. PAUL, MINN.—We are informed that the Western Transportation Company will soon be in the market for material for the construction of several electric railways in which it is interested. One of the railways will extend from Portage to Grand Rapids, via Briggsville, Oxford and Friendship, a distance of 70 miles, for which surveys and rights of way have been secured for a distance of 30 miles from Portageville, via

Briggsville to Oxford. Contracts have been let for ties and grading. The company also contemplates building a railway from Galesville to Ettrick, Wis., a distance of about 10 miles, and is also considering the construction of an interurban railway 60 miles in length in Montana. J. N. Braun is president of the company.

WARREN, MINN.—The Springfield Boiler & Manufacturing Company, of Springfield, Ill., has been awarded the contract for furnishing a 125-hp internal furnace boiler for the municipal electric light plant for $1,850. W. Haney is superintendent of the plant.

MOUNT OLIVE, MISS.—The Town Council has awarded the contract for the installation of the municipal electric light plant to K. Cramer, of Hazlehurst, Miss.

CASSVILLE, MO.—Arrangements are being made by the Cassville & Western Railroad Company to equip its railroad, now operated by steam power, between Cassville and Exeter, Mo., a distance of five miles, to be operated by electricity, which may be extended to Carthage, Mo., and ultimately to Eureka Springs, Ark. The present plans contemplate the development of water power of White River, to be utilized for the generation of electricity, and the erection of a power house in Cassville.

ELDORADO SPRINGS, MO.—B. F. Proctor is reported to be receiving bids for the construction of an electric light plant.

KANSAS CITY, MO.—Arrangements are being made by the Interstate Railway Company to commence work on the construction of its proposed electric railway from Kansas City to Dearborn and St. Joseph, a distance of 48½ miles, about June 15. George R. Collins is president.

LICKING, MO.—Announcement has been made that the Rolla-Cabool Interurban Railway Company has made financial arrangements for the construction of its proposed electric railway passing through Licking, Raymondville and Houston. The railway will be 75 miles in length. E. E. Young, of Licking, is promoter of the project.

ST. LOUIS, MO.—As a result of the decision handed down by Judge Grimm, of the United States circuit court, the Board of Public Improvements has granted the West End Light & Power Company permission to erect its wires in front of the property of W. Hall Trigg, who sought an injunction to prevent the company from erecting its transmission lines in this city. The company purchased the franchise of Browning, King & Company several years ago. Jesse D. Dana is president of the company.

ST. LOUIS, MO.—The Light & Development Company, which has secured the franchise held by A. S. Aloe and others, has applied to the Board of Public Improvements for permission to erect transmission lines in the West End. The company proposes to start the power plant in the Buckingham annex for the purpose of furnishing electricity for lighting the Buckingham and annex.

ARMSTEAD, MONT.—Barnett & Bates are reported to be interested in a project to construct an electric light plant on Beaverhead River.

LEWISTOWN, MONT.—S. W. Gebo, owner of the Spring Creek coal properties, located three miles from this city, has applied to the City Council for a franchise to install an electric light and gas system in Lewistown. A special election will be held soon to vote on the proposition to grant the franchise.

BANCROFT, NEB.—The citizens are considering the question of issuing $8,000 in bonds for the construction of a municipal electric light plant.

BRISTOW, NEB.—Plans have been completed by the Fairfax Mutual Telephone Company, the Spencer Telephone Company and the Bristow Mutual Telephone Company to erect a copper toll line from Lynch to Bonesteel, and later to extend it to Dallas.

CAMBRIDGE, NEB.—The plant of the Cambridge Electric Light Company is reported to have been destroyed by fire, causing a loss of from $20,000 to $25,000.

GARDNERVILLE, NEV.—A company has been organized by H. H. Springmeyer and A. Jensen, of Carson Valley, for the purpose of constructing a street railway from the terminus of the Carson Valley branch of the Virginia and Truckee Railroad to Gardnerville, a distance of one mile.

DUBLIN, N. H.—The Dublin Electric Company contemplates replacing the present street lighting system with series incandescent lamps with tungsten lamps. General Electric apparatus will be used. C. F. Appleton is treasurer and general manager.

DURHAM, N. H.—The Selectmen have granted the Lisbon Falls Gas & Electric Company a franchise to erect a transmission line for the distribution of electricity in Durham.

LACONIA, N. H.—The Laconia Electric Lighting Company has submitted a proposition offering to replace the present street arc lamps with 400 incandescent lamps of 32 cp.

HADDONFIELD, N. J.—The Borough Council is reported to be considering the question of installing a municipal electric light plant in connection with the water works. Mayor Roberts the second time has vetoed the ordinance authorizing a five-year contract with the Public Service Corporation for lighting the borough.

PEDRICKTOWN, N. J.—The citizens are considering the question of installing a lighting system in the town.

DEMING, N. M.—A bill has been introduced into the House of Representatives at Washington, D. C., providing for an appropriation of $300,000 for the construction of an electric power plant at Deming, to furnish electricity for an irrigation project. The work to be done under the supervision of director of the reclamation service.

LAS CRUCES, N. M.—The Las Cruces Electric Light & Ice Company is reported to be considering the question of installing a water works system in Las Cruces.

ALBION, N. Y.—Business men and capitalists of Middleport have agreed to pay $15,000 for the $30,000 in bonds, secured by a mortgage on the plant of the Middleport Gas & Electric Light Company, which will separate that company from the Lockport, Albion, Brockport and other enterprises consolidated under the name of the Albion Power Company, of which Sanford T. Church is receiver. Justice Wheeler at Buffalo has issued an order permitting the Middleport Gas & Electric Company to be turned over to the local bondholders. Sanford T. Church, receiver, stated that the other interests were willing to permit the sale of the bonds, with the understanding that the plant was to be turned over to those who purchased the bonds for operation. While the plant has been turned over to the purchasers of the bonds, the Albion Power Company still has some control of the property.

CASTILE, N. Y.—James C. Horning writes that he owns water rights, partly improved, located at Lamont, N. Y., three miles distant from Castile. It is estimated that 400 hp could be developed at the lowest water periods and contracts can be secured to furnish electricity to light four villages. The electric railway from Rochester to Letchworth's Park will run within 2½ miles of the park, and it is thought likely that it would purchase electrical power to operate the road. Mr. Horning would like to sell the property or interest parties with capital to carry out the project.

FORT TOTTEN, N. Y.—Sealed proposals will be received by the constructing quartermaster at Fort Totten, N. Y., until June 15, 1909, for the construction of an electric lighting system at Fort Totten. Plans, specifications and information furnished upon request at the above office. Plans and specifications may be seen at the office of the chief quartermaster, Governor's Island, N. Y.

FULTON, N. Y.—Plans are being made by the Oswego River Power Transmission Company for the construction of a transmission line from Baldwinsville to Fulton, N. Y., to transmit Niagara Falls power, which will be sold to the Niagara-Oswego Power Company. A substation will be erected, which will be equipped with three 250-kw transformers to change the voltage from 33,000 to 6600 volts. S. B. Storer, of Syracuse, N. Y., is president of both companies.

GENEVA, N. Y.—The Empire Coke Company contemplates extensive improvements to its plant, which will involve an expenditure of about $200,000, and will include the installation of two 150-hp gas engines, to be supplied by the Alberger Gas Engine Company, of Buffalo, N. Y., and two 100-kw Westinghouse generators. New gas compressors will be added. E. H. Palmer, of Geneva, is president and general manager.

MALONE, N. Y.—It is reported that the Malone Electric Light & Power Company has purchased the electric light plant owned by S. S. Whittelsey.

NEWBURGH, N. Y.—The Merchants' Association of Newburgh has appointed a committee to make investigations in regard to the construction of an electric light plant and for organizing a company to build the same. The report submitted to the association by George J. Wittman estimates the cost of the plant at $75,000. W. W. Hawkes, Alexander Goldberg, Charles Stones, Elting Burger and George Wittman are members of the committee appointed to look into the matter.

OLCOTT, N. Y.—The street lighting system has been completed and the service placed in operation. Electricity for the system is furnished by the Newfane Electric Company, of Newfane, N. Y.

ROCHESTER, N. Y.—The Rochester Railway & Light Company, through R. M. Searle, vice-president, has written to the Chamber of Commerce offering to send a representative into the field to induce manufacturers contemplating relocating their industries to locate in Rochester, offering among the advantages of the city the company's electrical service. The company offers to pay all of the expenses of the representative, and asked when in the field to represent the Chamber of Commerce.

ROSLYN, N. Y.—The Public Service Commission of the Second District has granted the petition of the New York & North Shore Traction Company for extensions and improvements to its railway from Roslyn on and along the North Hempstead turnpike to the easterly limit of the Borough of Queens at Little Neck.

ALBEMARLE, N. C.—J. C. Masters, president of the Albemarle Development Company, which is developing the water power of the Yadkin River for electrical purposes, writes that the company will be ready to receive prices on machinery for its plant in 60 or 90 days. The company recently awarded the contract for the construction of its dam to L. A. Moody, of Albemarle. The company contemplates an expenditure of about $1,000,000, which will include the construction of a large hotel, sanatorium, bathhouses, a large dam and power plant.

CARTHAGE, OHIO.—The Cincinnati Traction Company has been granted a 25-year franchise in Carthage, in return for which the company will give the people a five-cent fare. A railway line will be built out the Paddock Road from the Avondale line.

CLARINGTON, OHIO.—The Clarington Water & Electric Company has applied for a franchise to install an electric light system in Clarington. F. V. Iams and E. H. Yost are interested in the enterprise.

CLEVELAND, OHIO.—The Cuyahoga Light Company, of this city, has increased its capital stock from $150,000 to $350,000.

MASSILLON, OHIO.—The City Council has granted a franchise to the Massillon Electric & Gas Company, successor to the Massillon Light, Heat & Power Company, to construct and operate electric light, heat and power systems in Massillon. The company agrees to light the city hall and three engine houses free of charge as long as it is given an exclusive franchise. The city reserves the right to regulate at intervals of not less than five years the price at which the company may furnish heat and power.

RICHWOOD, OHIO.—The proposition to issue $20,000 in bonds for the construction of a municipal electric light plant was defeated at a recent election. The contract with the Richwood Light, Heat & Power Company has expired, and the streets of the town are now in darkness. The Council will award the next contract to the lowest bidder.

SPRINGFIELD, OHIO.—The Springfield Light, Heat & Power Company has purchased a site for its new power plant. As soon as plans and specifications are completed for the plant, bids will be called. The company has placed a contract with the General Electric Company, Schenectady, N. Y., for a 2700-hp steam turbo-generator set. The cost of the new building and equipment is estimated at about $200,000.

STEUBENVILLE, OHIO.—The Harrison & Jefferson Telephone Company is making arrangements for the erection of additional toll lines between Steubenville and Martins' Ferry and Bowerston.

ZANESVILLE, OHIO.—Plans are being considered for the construction of an interurban electric railway between Zanesville and McConnellsville, Pa. The new company will be known as the Zanesville & McConnellsville Traction Company. It is proposed to connect the new railway with the Marietta & Parkersburg line, now under construction. A. W. McDonald, of Pittsburg, Pa., and R. C. Burton are interested in the project.

CHICKASHA, OKLA.—C. G. Johnson, superintendent of the Chickasha Light, Heat & Power Company, writes that the company proposes to reconstruct its entire plant and will probably install steam turbine generators. The cost of the work is estimated at $60,000. Clarence G. Johnson, of Chickasha, is engineer in charge of the work.

GRANITE, OKLA.—At the coming election the citizens will vote on the proposition to erect a municipal electric light and water plant to cost about $45,000.

HOBART, OKLA.—The Carnegie Power & Transmission Company, recently incorporated, is preparing plans for the construction of a hydro-electric plant at Carnegie, Okla. The company also proposes to construct an auxiliary plant, with an output of 1000 hp, at Gotebo, which will be equipped with four gas engine units of 250 hp each. Natural gas will be used for fuel.

OKLAHOMA CITY, OKLA.—The John A. Stewart Electric Company, of Cincinnati, Ohio, has purchased the engines and generators, which have been discarded at the plant of the Oklahoma Gas & Electric Company.

CORVALLIS, ORE.—Ernest A. Miller is reported to be interested in a project to organize a company to construct an electric railway from Corvallis to Alsea, via Philomath. The company will be known as the Corvallis & Southwestern Railway Company.

HILLSBORO, ORE.—It is reported that the city has accepted the offer of a syndicate of capitalists for the purchase of the municipal water and light plant, for a consideration of $15,500. The Council will grant the company a 25-year franchise. The new company proposes to construct a new sawmill and will utilize the sawdust and slabs for fuel for the plant. It also proposes to extend and improve the system. John A. Stephenson, of Portland, Ore.; T. R. Yerger, of Everett, Wash., and C. E. Lytle, of Hillsboro, are interested in the company.

JACKSONVILLE, ORE.—A franchise has been granted to the Citizens' Telephone Company to build and operate a telephone system in Jacksonville, and to connect with the rural telephone lines operating in this town; also to construct connecting telephone lines to Central Point, Medford, Phoenix and several other villages in the Rogue River Valley.

MARSHFIELD, ORE.—The County Commissioners have granted J. F. Clark and J. H. Somers a franchise to construct an electric railway over the county road between Marshfield and Coquille.

SPRINGFIELD, ORE.—The McKenzie Valley Irrigation & Power Company, recently organized by farmers to irrigate a large area of country, has been granted a franchise in Springfield to erect an electric plant to supply electricity for lamps and motors. The company agrees to have its system in operation within 18 months and to sell its plant to the city at the end of 25 years if it wishes to buy.

CONEMAUGH, PA.—The Conemaugh Electric Company, recently incorporated, is said to have submitted a proposition to the City Council for the purchase of the municipal electric light plant. The company is capitalized at $50,000.

IRWIN, PA.—The directors of the Manor Valley Railway Company have decided to construct a power plant to supply electricity to operate the Irwin-Herminie Railway.

NEWVILLE, PA.—The Town Council has granted the Cumberland Railway Company a franchise to construct an electric railway in this town.

PHILADELPHIA, PA.—The Hyde Windlass Company, of Providence, R. I., has secured the contract for furnishing one electric capstan at the navy yard at Philadelphia, Pa., for $10,369.

PHILADELPHIA, PA.—The International Gas & Electric Company has absorbed the plants of the Citizens' Electric Light, Heat & Power Company, of Clifton Heights, and the Philadelphia Suburban Electric Company. The two companies have practically been supplying all of the boroughs and townships of Delaware County with electricity. It is said that the consolidation will mean the construction of a large central power plant, which will furnish electrical service throughout the county. It is also understood that the Media Electric Light Company is a part of the new company. It is reported that A. S. Dowling, superintendent of the Media plant, will be general manager of the consolidated company.

SCHUYLKILL HAVEN, PA.—Bids will be received until May 31 by George E. Runkle, secretary of the Town Council, for furnishing and installing a 300-hp engine, a 200-hp boiler and a 200-kw generator in the municipal electric light plant.

SOUTH BETHLEHEM, PA.—The Halcyon Electric Light & Power Company has been reorganized and has voted to increase its capital stock to $60,000. The company has secured a 5-year contract to light the streets of the Borough of South Bethlehem.

TITUSVILLE, PA.—We are informed that the Titusville Northern Railroad Company is in the market for electrical supplies for its railway systems at Titusville, Union City and Cambridge Springs, Pa. Jesse L. Strauss is treasurer.

GREENVILLE, S. C.—The Paris Mountain Electric Company has applied to the City Council for a franchise in Greenville. The company proposes to construct an electric railway from Greenville to the summit of Paris Mountain. A. E. Sussex, of Greenville, is interested in the project.

WESTMINSTER, S. C.—A. B. Grace is interested in a proposition to develop the water power of Chauga's Creek and proposes to build a dam and power house, about four miles above Westminster, to furnish electricity in the towns of Westminster and Walhalla.

BELLE FOURCHE, S. D.—The Belle Fourche & Northern Telephone Company has commenced work on the construction of a telephone line between this city, Camp Cook and Buffalo, which later on will be extended from Buffalo to Bowman.

HILL CITY, S. D.—The Gold Medal Mining Company is contemplating the development of a water power, and if sufficient capital can be secured the company will install electrical machinery to furnish electricity to operate its mining machinery and for lighting the town of Hill City. About 200 hp can be developed. The company would like to interest parties who would furnish the capital necessary to construct the flume and install the machinery. The cost of the work is estimated at $40,000. R. T. Walker, of Hill City, S. D., is interested in the project.

LAKE PRESTON, S. D.—The Lake Preston Milling Company has been granted a franchise by the City Council to install and operate an electric light plant.

WHITE ROCK, S. D.—The White Rock Rural Telephone Company, it is said, contemplates extending its telephone lines to Diamond this coming season.

KNOXVILLE, TENN.—Plans are being made by William T. Lang for the construction of cotton mill for the manufacture of cotton cloth, which will be chartered under the name of the Castle Cotton Mills, Ltd. The company will be capitalized at $1,000,000 and proposes to erect mill buildings of concrete, to be equipped for electric motor drive. It is estimated that about 4000 hp will be required, which the company contemplates purchasing from the Knoxville Power Company.

MEMPHIS, TENN.—Plans are now being made by the collector of customs to improve the lighting system in the Federal building. The old part of the building will be rewired and new fixtures and appliances installed throughout. Tungsten lamps will replace the incandescent lamps now in use on the ground floor.

SPARTA, TENN.—The A. & T. Power Company is reported to have awarded contracts for equipment of its electric plant, including three Trump turbines, a 300-kw generator, governor, etc., to the Trump Manufacturing Company, of Springfield, Mass.

FT. SAM HOUSTON, TEX.—The contract for the installation of an electric invalid's elevator at Fort Sam Houston has been awarded to the Otis Elevator Company, of New York, N. Y., for $3,415.

RUTLAND, VT.—Negotiations are now under way between the Rutland Light & Power Company and the Delaware & Hudson Company, whereby the railroad of the Delaware & Hudson Company and Castleton and Eagle Bridge, between Fair Haven and Whitehall, may be equipped to be operated by electricity. If the deal goes through the Rutland company will take over the passenger traffic of the Delaware & Hudson company in this state. If the deal is not consummated the Rutland company will probably extend its electric railway to Poultney. G. Tracy Rogers is president of the Rutland Railway & Light Company.

ST. ALBANS, VT.—The Vermont Power & Manufacturing Company, it is said, contemplates extending its service in the near future. It is understood that a company will be formed to furnish electricity for lamps and motors in Jefferson, Cambridge Junction and Cambridge and will secure electrical power for the service from the Vermont Power & Manufacturing Company. If the present plan does not materialize the local company may extend its system to those villages.

BASIC CITY, VA.—Plans have been prepared for the construction of a hydro-electric plant for the city, which will include the construction of a concrete dam, power house, etc., bids for the construction of which will be received by W. M. Page, city treasurer. Plans and specifications will be furnished to bidders for $2.50.

HONAKER, VA.—Bids will be received by C. A. Honaker, recorder, until June 7 for an electric franchise in Honaker.

ONANCOCK, VA.—Harry L. Richardson, of Laurel, Del., electrical engineer, is reported to be interested in the construction of an electric light plant in Onancock.

CLE ELUM, WASH.—The Cle Elum-Roslyn Railway & Power Company will soon commence work on the construction of its proposed electric railway, which is to extend from Cle Elum to Roslyn, a distance of 12 miles. The power plant, it is said, will be located in Cle Elum. Frank S. Farquhar is interested in the enterprise.

CONCONCULLY, WASH.—It is reported that an electric light company is being organized in this city.

FRIDAY HARBOR, WASH.—The Inter-Inland Telephone Company and the International Telephone Company have each been granted a franchise to erect and operate telephone systems in Friday Harbor.

NOOKSACK, WASH.—The Washington Mining & Developing Company, which proposes to construct a hydro-electric plant on Collins Creek, six miles from Nooksack, has commenced work on the construction of its plant, the cost of which is estimated at $200,000. Major A. J. Reed, of Louisville, Ky., is president and general manager.

PORT ANGELES, WASH.—Thomas T. Aldwell, of this city, and George A. Glines, of Winnipeg, Man., owners of the water-power rights of the Elwha River at the Canyon, it is reported, contemplate the development of the water power in the near future.

TACOMA, WASH.—The Tacoma-Seattle Power Company has submitted a bid to furnish the city with an additional 1500 hp at 1¼ cents per kw-hour, the same rate that it is now furnishing 5000 hp to operate the municipal electric light system. The contract will expire Nov. 8, 1912, the same date the other contracts of the company expire, when it is expected that the hydro-electric plant on the Nisqually River will be completed.

WAITSBURG, WASH.—The Waitsburg Electric Light Company contemplates remodeling its plant and will install an auxiliary power plant to operate the system during the low water periods. The cost of the work is estimated at $3,000.

WENATCHEE, WASH.—The Entait Light & Power Company has applied to the City Council for a franchise to construct and operate an electric light and power plant in Wenatchee. The company agrees to furnish electricity for lighting the streets of the city at the rate of $96 per lamp per year for less than 10 lamps of 2000 cp with an all-night service and $84 per lamp per year on a contract of ten or more lamps for a term of three years or longer; the maximum charge for electricity for all lighting service not to exceed 15 cents per kw-hour and $50 per hp per annum for motors of 5-hp or over.

WHITE SALMON, WASH.—A franchise has been granted to erect and operate transmission lines in White Salmon.

WHEELING, W. VA.—The City Council has granted a franchise to the Rapid Transit Railway Company to construct and operate an electric railway over certain streets in the city. A. M. Schenk, of Wheeling, is president of the company.

WHEELING, W. VA.—The Wheeling Traction Company is planning to make extensive improvements this summer, including the purchase of eight new cars. The railway will be extended through Rayland; a new feed cable will be purchased and erected from the power house to Martins Ferry.

ANTIGO, WIS.—It is reported that F. C. Duchac, of Antigo, has applied to the Village Council for a franchise to install and operate an electric light plant in this village.

EAU CLAIRE, WIS.—The Wisconsin Telephone Company is planning to extend its system in this section of the state, which will involve an expenditure of between $10,000 and $15,000. General improvements are to be made at Hudson and New Richmond.

GRAND RAPIDS, WIS.—The Grand Rapids Street Railroad Company is making plans to commence work on the construction of its proposed electric railway, which is to extnd from Grand Rapids to Port Edwards and Nokoosa, seven miles in length. As yet no definite arrangements have been made for electricity to operate the railway. F. J. Wood, of Grand Rapids, is treasurer.

HARTFORD, WIS.—The Wisconsin Telephone Company is securing the right of way for a 40-wire toll line to be erected from Milwaukee to North Lake, Beaver Dam and to Stevens Point. The company expects to build as far as Beaver Dam this year.

HUBERTUS, WIS.—The capital stock of the Richfield, Hubertus & Holy Hill Telephone Company has been increased from $2,000 to $12,000.

MILWAUKEE, WIS.—The City Council has granted the Milwaukee Electric Railway & Light Company a franchise for several extensions to its lines in Milwaukee.

VIOLA, WIS.—E. R. Cushman, of Viola, Wis., writes that he has a good water power for sale and that there is a good opening to establish an electric light plant in Viola. The village has a population of 1000 and is anxious to have an electric system installed.

LETHBRIDGE, ALTA., CAN.—The ratepayers have voted in favor of spending $132,000 for the construction of an electric light and power plant. Address the mayor.

VANCOUVER, B. C., CAN.—Plans are being made by Frank Huston for the construction of a sawmill and planing mill in Vancouver. Both mills will be operated by electricity.

VANCOUVER, B. C., CAN.—The British directors of the British Columbia Electric Street Railway Company have voted $2,500,000 for extensions and improvements to be made to the system this summer. R. H. Sperling, of Vancouver, is general manager.

VICTORIA, B. C.—The British Columbia Electric Railway Company, it is said, has been making investigations at Jordon River with the view of increasing its supply of power, and if negotiations are consummated with the city it will probably establish a new plant at a cost of about $2,000,000. It is estimated that 10,000 hp can be developed all the year around. The proposition calls for a series of reservoirs for the storage of surplus water.

BROOMHILL, MAN., CAN.—The Municipality of Albert has voted in favor of a municipal telephone system. For further information address W. Kilkenny, Broomhill, Man.

WINNIPEG, MAN., CAN.—At the annual meeting of the Winnipeg Electric Railway Company it was decided to issue $1,500,000 in new stock for extensions and improvements to its system.

NEW GLASGOW, N. S., CAN.—The plants, properties, franchises, etc., of the New Glasgow Electric Light Company, it is reported, have been transferred to the Egerton Tramway Company.

COBOURG, ONT., CAN.—The council has granted the Provincial Steel Company permission to build an electric railway from its plant to the lake front. The Cobourg, Port Hope & Havelock Electric Railway Companies have also been given permission to enter the town.

HAMILTON, ONT., CAN.—The Board of Aldermen has accepted the offer of the Hamilton Electric Light & Power Company to furnish electricity for the illumination of Gore Park and extension from May 24 until Sept. 30 for $550, and for the city hall sign for the same period for $50.

LONDON, ONT., CAN.—Tenders will shortly be called for the supply of wires, insulators, cross-arms, poles, etc., for the distribution system in connection with the Hydro-Electric Power Commission project. For further information address E. I. Sifton, city engineer.

ODESSA, ONT., CAN.—The Ernestown Telephone Company, with main office in Odessa, has been incorporated. For further information address J. F. Dawson.

STRATFORD, ONT.—A proposition has been submitted to the City Council by N. M. Cantin, of St. Joseph, on behalf of New York capitalists, offering to construct an electric railway between St. Joseph and Stratford, a distance of about 65 miles, upon condition that the city guarantee bonds of the company to the amount of $250,000.

TORONTO, ONT., CAN.—Representatives from the municipalities of Acton, Brampton, Georgetown and Milton on May 10 held a conference with the chief engineer of the Hydro-Electric Power Commission in regard to contracts for the supply of electrical power.

TORONTO, ONT., CAN.—Contracts have been awarded by the Board of Control for conduits and cables for the municipal electrical distributing plant to cover the southern portion of the city from Dufferin Street to Don and south of Queen Street. For cables to the British Insulated & Helsby Cables, Ltd., of Prescot, England. The prices varying from 20 cents to $1.34 per ft. From 75,000 to 100,000 ft. of cable will be used. The contract for conduit was given to the American Pipe Company, of Akron, Ohio, at 4 7/10 cents per ft. Single-duct conduit will be used. K. L. Aitken is city electrical engineer.

MONTREAL, QUE., CAN.—The Dominion Government is now considering the electrification of the Intercolonial Railway from Montreal to Moncton, N. B. The water power at Grande Rapids will be developed to furnish electricity to operate the railway if the plan is carried through. D. Pottinger, Moncton, N. B., is general manager.

New Industrial Companies.

THE BRIGHTON ELECTRIC COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $2,000 for the purpose of doing general electrical work. The incorporators are William D. Taylor, Edward McCourt and John W. Taylor, of West New Brighton, N. Y.

THE CONTINENTAL ELECTRIC COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $12,000, for the purpose of doing a general electrical engineering and contracting business by Harry Bierm, E. E. Schmuck and Alje Bierm.

THE ELECTRIC EQUIPMENT COMPANY, of Oakland, Cal., has been incorporated by G. F. Bulen and others.

THE ELECTRICAL WIRING COMPANY, of New York, N. Y., has been chartered with a capital stock of $1,000 by Theodore Trendelberg, of Jersey City, N. J.; Russell G. Gory, of Montclair, N. J., and Joseph S. Merline, of New York, N. Y. The company proposes to do general electrical work.

THE JAMES P. MARSH & COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $50,000 by Charles H. Frank, M. N. Miller and Daniel Scanlan. The company proposes to manufacture gages and valves.

LEONARD KEIL, of New York, N. Y., has filed articles of incorporation, with a capital stock of $2,000, for the purpose of dealing in machinery, engines, boilers, etc. The incorporators are: George Deulerman, Winifred E. Keil and Leonard Keil, of West New York, N. J.

THE LIVINGSTON RADIATOR & MANUFACTURING COMPANY, of New York, N. Y., has filed articles of incorporation for the purpose of manufacturing motors, engines, cooling and heating radiators, etc. The company is capitalized at $100,000, and the incorporators are John N. Boyle, Albert S. Rockwood and Thomas Roberts, all of New York, N. Y.

THE MISSOURI ELECTRIC STORAGE BATTERY COMPANY, of St. Louis, Mo., has been incorporated, with a capital stock of $25,000, by N. P. L. Rosch, E. M. Cooper, Charles Wilson and others. The company proposes to manufacture storage batteries.

THE NATIONAL RAILWAY DEVICES COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $200,000, by Francis E. Hickley, Harry J. Berman and William L. Carlin. The company proposes to manufacture railway supplies and appliances.

THE NATIONAL TELEPHONE EQUIPMENT COMPANY, of Columbus, Ohio, has been incorporated, with a capital stock of $175,000, by W. F. O'Gara, R. C. M. Hastings, Thurston Matheny, J. P. Hazelton and R. L. Tuggle.

THE PHOENIX BRASS & METAL COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 by Edward Gunnell, Stephen McFarland and Patrick J. O'Brien, all of New York, N. Y. The company proposes to manufacture steam, water apparatus, valves, etc.

THE SYRACUSE INDUSTRIAL GAS COMPANY, of Syracuse, N. Y., has been incorporated by Leon F. Smith, Nelson H. Henderson and Charles L. Ackerman, all of Syracuse, N. Y. The company is capitalized at $15,000 and proposes to manufacture gas producers, motors, engines, machinery, tools, etc.

THE TELEPHONE IMPROVEMENTS COMPANY, of Boston, Mass., has been incorporated, with a capital stock of $50,000, for the purpose of manufacturing telephone apparatus. F. F. Phillips, Jr., is president, and M. Wood, treasurer and clerk, both of Boston, Mass.

New Incorporations.

PRESCOTT, WASH.—Articles of incorporation have been filed for the Prescott Telephone & Telegraph Company by Joseph Utter, W. W. Winkle, J. D. Walter, Charles H. O'Neil and L. Burman, all of Prescott. The company is capitalized at $2,000.

SOUTH PRAIRIE, WASH.—Articles of incorporation have been filed for the South Prairie Light & Manufacturing Company by A. Anderson and others. The company is capitalized at $10,000.

VANCOUVER, WASH.—The Home Telephone Company has filed articles of incorporation with a capital stock of $150,000. The incorporators are: Judge W. W. McCredie, H. C. Phillips, A. L. Miller, J. D. Eaton, all of Vancouver, Wash., and Robert Tucker, of Portland, Ore.

FAIRVIEW, W. VA.—The Proctor & Peabody Telephone Company has been chartered, with a capital stock of $5,000, by E. R. Parsons, Albert Ganer and J. M. Wells, all of Proctor, W. Va.

FAYETTE, W. VA.—Articles of incorporation have been filed for the Fayette County Traction Company, with a capital stock of $75,000, by R. D. West, John Reese, E. G. Blume, C. E. Nestor, W. G. Wheatley, all of Fayette. The company proposes to construct an electric railway from Fayette Station to Fayetteville.

HUNTINGTON, W. VA.—The Cabell-Lincoln Rapid Transit Company has been incorporated, with a capital stock of $10,000, by S. G. Griffith, L. H. Cammack, S. H. Bowman, H. S. Byrer and J. T. Colbert, all of Huntington. The company proposes to operate and control motor carts for general transfer purposes.

NELSON, W. VA.—The Aaron's Creek Telephone Company has been incorporated with a capital stock of $5,000 and the following officers: D. T. Winston, president, of Virgilina, Va.; A. H. Nelson, of Nelson, vice-president, and T. B. Nelson, of Nelson, secretary and treasurer.

WALLACE, W. VA.—The Wallace Telephone Company has been incorporated, with a capital stock of $5,000, by D. C. Bennett, G. W. Schrader and Homer E. Hildreth, of Wallace, and A. Hayes Moore, of Mannington, W. Va.

CECIL, WIS.—The Cecil-Green Valley Toll Line Company has been organized to construct a telephone line from Cecil to Green Valley station and to within a mile of Pulcifer. About 25 miles of telephone line will be erected this summer. The officers of the company are: J. S. Bremich, president; Anton Berg, vice-president; J. H. Kuehl, secretary and treasurer, and Herman Borcher, manager.

DOUSMAN, WIS.—The Dousman & Marlboro Railroad Company has been incorporated, with a capital stock of $25,000, to construct an electric railway between Dousman and Marlboro, 6¾ miles in length. The incorporators are: James M. Pereles, Thomas J. Pereles, Mason Pereles, Jr.; William H. Lindwurm and Henry Campbell.

EAU CLAIRE, WIS.—The Riverview Telephone Company, of Riverview, Wis., has been incorporated with a capital stock of $20,000 by John H. Perkins, Frank Knight and D. W. Shoudy.

ELEVA, WIS.—The Eleva Farmers' Telephone Company has been incorporated with a capital stock of $8,000 by J. A. Nelson and others.

OCONTO, WIS.—The Oconto Rural Telephone Company has been incorporated with a capital stock of $5,000 and the following named officers: George Glynn, president; Yarwood Matravers, vice-president; H. L. Reeves, secretary.

TAYLOR, WIS.—The Springfield Farmers' Telephone Company has been incorporated with a capital stock of $6,000 by John Lambert and others.

PORTAGE LA PRAIRIE, MAN., CAN.—The Manitoba Power & Electric Company has been incorporated with a capital of $100,000. The provisional directors are: W. H. Carter, A. H. Aldinger and A. J. Williams, of the Carter-Halls-Aldinger Company, Winnipeg, Man., and Chicago, Ill.

ROSEWOOD, MAN., CAN.—The Rosewood Rural Telephone Company has decided to build at once a telephone line to Ste. Anne. G. Claydon is manager.

ALTONA, ONT., CAN.—The Central Telephone Company has been incorporated here, with a capital of $40,000. J. Underhill is secretary.

APSLEY, ONT., CAN.—The Apsley Telephone Company has been incorporated with a capital of $10,000 by D. Brown, Z. Tucker, of Apsley, and D. Davidson, of Peterborough, Ont.

COBOURG, ONT.—The Cobourg, Port Hope & Havelock Electric Railway Company has been incorporated to construct an electric railway to extend across Northumberland County to Warkworth and Campbellford, thence to Havelock, with branches from a point near Warkworth to Roseneath and Hastings, by H. T. Bush, E. S. Huycke, of Port Hope; W. J. Crossen, of Cobourg, and Reeve J. Knox, of Havelock. H. A. Ward, of Port Hope, is secretary.

THAMESVILLE, ONT., CAN.—The Thamesville Telephone Company has been incorporated with a capital of $10,000. The provisional directors are: W. J. Mitton, Camden; T. Marven, J. Coutts, of Thamesville, Ont.

ABERNETHY, SASK., CAN.—The Foster Rural Telephone Company has been incorporated with a capital of $5,000.

Legal.

FRANCHISE HELD VALID.—A decision of the circuit court handed down by Judge Grimm May 5 gives the West End Light & Power Company, of St. Louis, Mo., the right to erect transmission lines in St. Louis under the franchise granted to Browning, King & Company in 1885, which was purchased by the West End company several years ago. Judge Grimm, in his decision, holds that the franchise is not void because of the failure of the original grantee to carry out the full provisions. W. Hall Trigg sought an injunction against the company to prevent it from erecting wires in front of his property. Jesse D. Dana is president, and Arthur Kloes, vice-president and secretary of the company.

Personal.

MR. THOS. D. LOCKWOOD delivered an address at the May meeting of the Pittsfield A. I. E. E. Branch on "The Satellite Systems of Primary or Pioneer Inventions."

COUNT VON BERNSTORFF, German Ambassador to the United States, was a distinguished visitor at the West Allis plant of the Allis-Chalmers Company in Milwaukee on May 7.

MR. C. E. STEPHENS, of the Westinghouse Electric & Manufacturing Company, presented a paper on the subject of street lighting before the Pittsburgh A. I. E. E. Section at its meeting on May 11.

MR. R. C. McMILLAN has become chief statistician of the Buffalo Electric Company, Buffalo, N. Y. Formerly Mr. McMillan was connected with the statistical department of the Commonwealth Edison Company, Chicago, which is in charge of Mr. E. J. Fowler.

MR. WILLIAM F. SMITH, formerly connected with the electrical department of the New York Central Railroad and the Otis Elevator Company and for the past few years electrical engineer for the Virginian Railway, has been appointed general manager of the Electrical Alloy Company, of Morristown, N. J., manufacturer of Phoenix and Ideal resistance wires.

MR. JOHN J. SCHAYER has been appointed manager of the Electric Shop, which is the beautiful downtown display rooms of the Commonwealth Edison Company, Chicago. The Electric Shop will be a separate department of the company's business, and Mrs. E. L. Stickney, who has direct charge of the reception rooms and salesrooms, and Mr. F. C. Prabel, stockkeeper, will report to Mr. Schayer.

MR. PAUL H. BATE has the distinction of obtaining the largest amount of new business to the credit of any solicitor for the Commonwealth Edison Company during the year 1908. Mr. Bate's record for this year is the handsome total of 56,500 16-cp lamp equivalents, or 2,825 kw. Mr. Bate won the first prize of $500 in the N. E. L. A. competition of last year for the best power solicitor's handbook. He evidently practises what he preaches.

MR. D. J. FLEMING, who was for several years connected with the Allis-Chalmers Company, of Milwaukee, Wis., in the power and contract department, has recently joined the Westinghouse Electric & Manufacturing Company in the capacity of sales engineer, with headquarters at East Pittsburgh, Pa. Mr. Fleming was also connected with the General Electric Company at Schenectady, N. Y., for a number of years, where

he took a complete course in the testing department and later served in the sales engineering department.

MR. J. H. DAVIS.—Announcement has been made of the promotion of Mr. J. H. Davis from assistant electrical engineer to electrical engineer of the Baltimore & Ohio Railroad, with headquarters at Baltimore. Mr. Davis succeeds Mr. L. T. Gibbs, who died several months ago. Mr. Davis is a graduate of the University of Arkansas, where he studied both civil and electrical engineering, completing the course in civil engineering to the middle of the senior year and receiving his degree as electrical engineer in 1897. From that time until March 17, 1901, he was associated with the St. Francis Levee Board, doing dike and levee work along the Mississippi River north and south from Memphis, under the supervision of the United States Army. From March, 1901, until October, 1905, when he entered the Baltimore & Ohio service, Mr. Davis was connected with the electrical department of the Pennsylvania Railroad at Altoona, Pa.

MR. W. H. COLMAN, who has been for several years assistant manager of the supply department of the Chicago office of the General Electric Company, has been promoted to be manager of the department, succeeding Mr. F. N. Boyer in that position. Mr. Boyer is assistant manager of the Chicago office, and henceforth will give his entire time to general problems of administration, assisting Manager J. W. Johnson. Mr. Colman has had an experience in the electrical business dating back to 1889, when he entered the employment of the old Edison General Electric Company in Chicago under Mr. John I. Beggs, district manager. He began as a mailing clerk, but he was soon advanced to the position of city salesman, in which he continued after the consolidation of the Edison company with the Thomson-Houston Company to form the General Electric Company in 1892. In 1895 Mr. Colman went to Detroit in charge of the Detroit office of the General Electric Company, but the year following he was transferred back to Chicago as assistant manager of the supply department in the Chicago office, a position he continued to fill until his recent promotion.

PROF. HENRY S. CARHART will retire Oct. 1 as head of the Department of Physics, University of Michigan, and receive a pension from the Carnegie foundation. Prof. Carhart has occupied the chair of physics at Ann Arbor since 1886, having previously been professor of physics at Northwestern University (1872-1886). In 1865 he entered Yale, and shortly after went to Wesleyan University, from which he was graduated with the degree of B.S. After graduation he taught school for two years, then took one year's post-graduate work at Yale, which was followed by a course in the Harvard summer school of chemistry. Prof. Carhart for some years made a specialty of the primary battery, on which subject he is the author of an authoritative treatise. He also has paid much attention to electrical measurement. The work by which he is best known, however, is in connection with the standard cell, his improvement of the Clark cell having been adopted at the Chicago Electrical Congress as the international standard. Prof. Carhart has been a leading delegate at several of the international electrical congresses, and served a term as president of the American Electrochemical Society. He has received a number of honorary degrees, among others that of LL.D. from Wesleyan University. Always an exponent of the highest ideals, Prof Carhart has been a forceful factor in American scientific and educational circles; and with leisure now to carry on research work unimpeded, science has gained rather than lost by his retirement from teaching. He will attend the Darwin centennial celebration in London, June 22-24, as the representative of the University of Michigan, returning in September. His retirement takes effect Oct. 1, when he will receive the title of professor emeritus.

PROF. HENRY S. CARHART.

Obituary.

MR. C. I. ZIMMERMAN, post-graduate student at the University of Wisconsin, died at Madison May 15 as the result of exposure in the lake following the capsizing of a boat. Mr. Zimmerman was formerly connected with the Carborundum Company at Niagara Falls as electrochemical engineer. He contributed a number of papers on electrochemical subjects to technical journals and *Transactions of Societies*, and at the recent Niagara Falls meeting of the American Electrochemical Society presented two papers. His death at an early age is a distinct loss to the profession in which he had already become a prominent figure.

Trade Publications.

RHEOSTATS.—The American Electric Fuse Company, Muskegon, Mich., in a catalog just issued, describes and illustrates Allen-Bradley rheostats and electric controlling apparatus. These devices are described with great minuteness, and dimension diagrams and price-lists are given.

WIRES, CABLES AND CORDAGE.—The Belden Manufacturing Company, Chicago, has issued its catalog No. 4, of electrical wires, cables and cordage. This catalog covers wire of all kinds and gives a great deal of information. It contains many useful tables and is well illustrated.

NATIONAL METAL MOLDING.—With the title "It's a Snap" the National Metal Molding Company, Pittsburgh, has issued a folder in which the advantages of metal molding are brought out by reference to an illustration of an installation made for the Fidelity Title & Trust Company, Pittsburgh.

CONDENSING APPARATUS.—In a pamphlet of recent issue the A. S. Cameron Steam Pump Works, East Twenty-third Street, New York City, describes and illustrates Cameron condensing apparatus. The company has extended its line of manufacture to cover jet and surface condensers for high vacuum steam turbine work.

REGENERATIVE FLAMING ARC LAMP BULLETIN NO. 79 of the Adams-Bagnall Company, Cleveland, has for its subject the new flaming arc lamp made by this company, which differs radically from the typical flaming arc. By means of two side tubes a constant circulation of gases is maintained between the top and bottom of the inner globe surrounding the arc, thereby intensifying the light and giving rise to the name "regenerative."

DIXON GRAPHITE PRODUCTS.—The Joseph Dixon Crucible Company, Jersey City, has issued a pocket edition of its general catalog, which lists its principal products, such as crucibles, facings, lubricating graphite, greases, pencils, protective paint, etc., giving brief descriptions and prices. The booklet is of commercial envelope size, and will conveniently go in the pocket or desk pigeonhole. It is substantially bound in tough cover stock, and attractively printed.

Business Notes.

THE STUART-HOWLAND COMPANY, of Boston, has recently added six new men to its already large force of salesmen on the road in order to take advantage of the increasing market offered for its various lines.

THE MOORE ELECTRICAL COMPANY, of Newark, N. J., has recently completed installations of white Moore Light tubes in the works of the United Piece Dyeing Company, Paterson, and those of Cheney Brothers, South Manchester, Conn. A. Hall, the Broadway photographer, has also had the underside of his skylight ribbed with Moore tubes in order to be entirely independent of daylight.

THE TAUNTON-NEW BEDFORD COPPER COMPANY has occupied its new factory at Taunton, Mass., where it will carry a full stock of made-up parts of Hill switches so that shipments can be made the day following the receipt of an order. The company is now prepared to give estimates on switchboards of any size for both direct and alternating current service. An addition will soon be made to the new factory for the manufacture of steel cabinets for switch and panel-board work.

THE WAGNER ELECTRIC MANUFACTURING COMPANY has opened an office in Denver, Col., located in the Ideal Building. This new office is in charge of Mr. O. H. Davidson, of the Electric Manufacturers' Sales Company. Mr. Davidson will have charge of the Wagner company's business in Colorado, New Mexico, Utah, Montana and eastern Idaho. Mr. Davidson has been located in Denver for the past three years and has a wide acquaintance in the electrical line in his territory.

GRANT FLAMING ARC LAMPS.—The German-American Electric Company has been awarded a contract for the installation of 20 flaming-arc lamps by A. Holthausen, the largest dry goods dealer in Union Hill, N. J. The lamps will be installed throughout the Holthausen building and will burn with white carbons. The German-American company states that this is probably the first time a contract has been awarded for flaming-arc lamps for this purpose, and that the order was received in competition with clockwork feed lamps.

THE DARLEY ENGINEERING COMPANY, builders of patented suction conveyors, has discontinued its Pittsburgh office, and its engineering, purchasing and sales departments hitherto located there have been transferred to the main office in the Singer Building, New York City. The Chicago office will remain, as at present, in the Monadnock Building. The new officers of the company are as follows: W. A. Stadelman, president and general manager; C. L. Inslee, vice-president; W. G. Hudson, vice-president; W. W. Ricker, treasurer, and M. D. Chapman, secretary.

THE KIMBLE ELECTRIC COMPANY, of Chicago, in its new factory at 324-326 Washington Boulevard, has twice the capacity of its old factory, but the orders received since the change have also doubled in number, so that the company still finds it difficult to keep up with the demands of its business. Variable-speed alternating-current motors are made in sizes from ⅛ hp to 1½ hp. They are adapted for driving printing presses, pipe organs, blowers, etc., and the company is bringing out a new motor which may be varied in speed from 100 to 5000 r.p.m. and reversed by simply throwing a lever. Mr. Austin Kimble, the inventor of this motor, is manager of the company.

ALLIS-CHALMERS GAS ENGINES.—At the West Allis works of Allis-Chalmers Company there is great activity in the gas engine building line, as a result of orders crowding close upon others received since the

first of the year, the units of which are now being assembled for shipment. Among orders just received are for three gas engines, aggregating 1000 hp, direct connected to three Allis-Chalmers electric generators, for the Palmetto Phosphate Company, Tiger Bay, Fla.; a gas engine of approximately the same size, with generator, for the Armstrong Cork Company's plant at Camden, N. J.; a 1500-kw gas-driven electric unit and seven standard 30,000 cu. ft. gas-driven blowing engines for various blast furnace plants.

DOSSERT & COMPANY, 242 West Forty-first Street, New York City, manufacturers of solderless connectors, cable taps and terminal lugs, will exhibit this year at the coming convention of the National Electric Light Association at Atlantic City a number of improvements and new applications of its devices of special interest to central-station engineers, including elbows for connecting ingoing and outgoing solid buses through oil switches; special lugs for remote-control switches; special two-way studs for tapping from solid rods direct to buses and special studs for transformer connections. Dossert & Company also expect to exhibit at Atlantic City for the first time the results of thorough and exhaustive tests of their devices now in progress at Cornell University.

THE HOLOPHANE COMPANY MOVED.—The general offices of the Holophane Company, with the headquarters of the sales and engineering departments, have been moved to Newark, Ohio, where Holophane glass is manufactured. The business of the company has been handled heretofore from New York City, but in the interests of more prompt shipments and to better serve the steadily increasing market, the concentration of the entire organization was deemed advisable. The branch offices of the sales department located in New York, San Francisco, Boston and Chicago, however, will continue as before. Only one working day was lost between the cessation of the business in New York and the opening in Newark. Practically the only inconvenience experienced by customers was due to delay caused by mail being misdirected to New York after the closing of the old office.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 11, 1909.

[Conducted by Wm. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

920,906. ELECTRIC COOKING VESSEL; F. Bolling; Frankfort-on-the-Main, Germany. App. filed Nov. 5, 1908. Heats the side of the vessel by means of a heating element placed directly on the vessel and a projecting strip soldered to the vessel over the element and insulated therefrom.

920,920. COMMUTATOR FOR DYNAMO ELECTRIC MACHINES; F. W. Cox, Wilkinsburg, Pa. App. filed April 4, 1906. Commutator consists of a clamping ring with auxiliary clamping rings engaging intermediate portions of the segments.

920,925. VOLTAGE REGULATOR; F. Darlington, Pittsburgh, Pa. App. filed March 3, 1906. Voltage variations are effected by varying the active lengths of transformer windings by means of a contact wheel driven by a motor which contacts successively with the windings.

920,926. MOVABLE TERMINAL FOR VOLTAGE REGULATORS; F. Darlington, Pittsburgh, Pa. App. filed March 3, 1906. A plurality of contact rings are arranged side by side on a common axis and are resiliently mounted thereon by means of springs. The rings engaged the windings of a transformer so as to produce a contact switch. (See 920,925.)

920,927. INDICATING MEANS FOR INSTRUMENTS; H. P. Davis and P. MacGahan, Pittsburgh, Pa. App. filed Oct. 21, 1905. A synchronism indicator having relatively movable members connected respectively to the sources of alternating current, a lamp carried by an arm operated by one of the members and stationary lamps serving as a resistance, and illuminating means.

920,932. ELECTRIC SIGNAL APPARATUS; C. E. Duffie, Omaha, Neb. App. filed April 27, 1907. For notifying the engineer of danger ahead by a cab signal operated by a differential relay in the cab and contact means controlled by stationary means on the track.

920,938. CONCENTRATING DEVICE FOR TELEPHONE TRANSMITTERS; O. F. Falk, Belleville, N. J. App. filed Aug. 21, 1908. A funnel-shaped mouthpiece having a passage leading directly toward the diaphragm and a second passage surrounding the diaphragh.

920,965. OZONE PRODUCER; S. M. Kintner, Pittsburgh, Pa. App. filed June 28, 1905. Combines a source of alternating current with a condenser, a single spark gap and a silent discharge gap connected in series therewith. The silent discharge produces the ozone.

920,966. TELAUTOGRAPH; A. M. & K. Knudsen, Chicago, Ill., and Grand Rapids, Mich. App. filed March 12, 1906. The device is provided with a transmitter, a receiver, a recording ribbon, a step-by-step ribbon feed and means for rendering the feed operative by lifting the tracing point of the transmitter from the writing table.

920,970. FOILED PAPER AND METHOD OF PRODUCING SAME; G. F. Mansbridge, Sanderstead, Eng. App. filed Jan. 13, 1906. Subjects each metal-plated sheet separately to the action of the electric current, thereby fusing the metal in proximity to the defective places without burning away the body of the paper, thus insultaing the defective part.

920,898. INDUCTION MOTOR; T. Abtmeyer, Wilkinsburg, Pa. App. filed July 13, 1907. A secondary member for induction motors with tubular conductors angularly disposed with reference to the axis and balancing rods in some of the conductors.

921,013. TRANSMITTING APPARATUS; H. Shoemaker, Jersey City, N. J. App. filed April 8, 1907. A high-frequency transmitter in which the discharge gap consists of two separated conductors immersed in a liquid, which liquid is common to the circuit including the prime source of energy and to a high-frequency circuit.

921,014. HYDRO-CONDENSER; H. Shoemaker, Jersey City, N. J. App. filed July 3, 1908. Includes a tank, a plurality of condenser units in the tank, each having a jar of dielectric material with conducting liquid in the jar forming a condenser armature and conducting liquid in the tank contacting with the outer sides of the jar to form the second armature.

921,018. ELECTRICAL APPARATUS; H. C. Soule, Wilkinsburg, Pa. App. filed Aug. 3, 1907. An alternate-current transformer suspended under the railway car with a cover plate and casing for the transformer.

921,025. OVERHEAD TROLLEY; J. C. Sturgeon, Erie, Pa. App. filed Jan. 29, 1908. A trolley wheel with two metal disks and central roller, together with inclined flanges on the edges of the disks carrying a contact ring and a removable bushing for graphite in the tubular hub of the wheel.

921,038. CEILING ROSETTE FOR DROP ELECTRIC LAMPS; W. Wilbraham, Chicago, Ill. App. filed July 14, 1908. The plug has an axial passage communicating with a lateral passage to receive the wires.

921,046. CIRCUIT INTERRUPTER; J. M. Wilson, Meriden, Conn. App. filed June 16, 1908. Makes use of a magneto having an armature with polar projections and a movable magnetic member attracted by the field magnet when the lines of force are unshunted by the armature and released when shunted by the armature and an electric circuit controlled by the movable member.

921,050. SNAP SWITCH; J. H. Wyatt, Philadelphia, Pa. App. filed Oct. 22, 1908. A double push-button snap switch having a pivoted contact member and a detent and operated by a coiled spring. Details.

921,053. TERMINAL STRUCTURE FOR ELECTRICAL APPARATUS; J. H. Zimmermann, Wilkinsburg, Pa. App. filed Nov. 4, 1905. For electrical measure instruments for supporting and protecting the terminals of the instrument by means of an insulating partition between the interior of the instrument and the terminal casing.

921,054. MAGNET SUPPORT FOR ELECTRICAL MEASURING INSTRUMENTS; J. H. Zimmermann, Wilkinsburg, Pa. App. filed Nov. 4, 1905. Supports a plurality of permanent damping magnets end to end on a strip which engages channels in the instrument frame.

921,060. ANNUNCIATOR; J. H. Ballweg, Baker City, Ore. App. filed June 18, 1908. For giving signals in hotel rooms, etc., by means of a rotary drum bearing a series of indicating characters operated by a motor, and started by means of a push-button.

921,108. MAGNETIC ELECTRIC-LIGHT HOLDER; D. J. Hauss, Aurora, Ind. App. filed Feb. 20, 1908. A magnet socket which retains its position when the current is cut off from the light, and which holds the light by means of magnet attraction to any desired position upon an iron object, such as machinery or structural iron, and which can be shifted.

921,116. SELECTIVE SIGNALING SYSTEM; A. W. Jones, Schenectady, N. Y. App. filed May 8, 1906. All the signals are automatically operated upon a breakdown. Normally energized magnets hold the signals at safety, and a signal switch somprising a ratchet wheel sets the signal.

921,119. TELEPHONE; A. G. Kaufman and L. J. Lippmann, New York, N. Y. App. filed Nov. 13, 1906. A plurality of receivers reproduce the same sound at different places and the transmitters are so grouped as to be simultaneously operated from the same source of sound.

921,141. SOUND TRANSMITTER AND RECEIVER; A. J. Mundy, Boston, Mass. App. filed April 23, 1902. Particularly for submarine signaling in which the carbon-containing cups forming the transmitter are contained within a sound-focusing shell and mounted on diaphragms.

921,145. PIPE CLAMP FOR GROUND CONTACTS; T. Nagel, Chicago, Ill. App. filed Dec. 31, 1908. Comprises a saddle with channels and a band having ends passing over the channels, together with a clamp bearing upon the band.

921,168. COMBINED LOCK AND SIGNAL AND LIGHTING SWITCH; W. R. Schlage, Berkeley, Cal. App. filed Dec. 14, 1908. Operates a signal and light when the door is opened by turning the knob of the door.

921,176. ELECTRIC RAILWAY SYSTEM; R. Stearns, Schenectady, N. Y. App. filed May 1, 1908. Opens the line switch of a car when the car enters upon an energized section, thereby disconnecting the car power circuit, but leaving the lighting circuit connected.

921,183. PROCESS OF REDUCING ORES; F. J. Tone, Niagara Falls, N. Y. App. filed April 11, 1906. A refractory receptacle contains the electrodes and the products of reduction are removed from the region of the arc as they are formed and kept in a fused state.

921,187. TELEPHONE EXCHANGE SYSTEM; H. G. Webster, Chicago, Ill. App. filed May 7, 1903. A busy test circuit for testing the condition of the called subscriber's line by means of a test relay of high resistance through which the test circuit is established.

921,196. DETACHABLE PLUG; P. R. Yuzuk, New York, N. Y. App. filed Aug. 17, 1907. A two-part plug, one part being left in the socket and the other disconnectable therefrom and provided with fuse links.

921,199. SOCKET FOR INCANDESCENT ELECTRIC LAMPS; D. E. Brown, Pittsburgh, Pa. App. filed March 6, 1906. Has a cap, a single solid base of insulating material carried by the cap for the terminals and connecting wires and an outer casing engaging with the cap by a threaded connection.

921,217. OVERHEAD TROLLEY SWITCH; E. C. Folsom, Logansport, Ind. App. filed Dec. 14, 1908. The overhead trolley switch has a movable menber operated simultaneously with the track switch to guide the trolley wheel across the switch to the main line trolley wire.

921,228. ELECTRIC FURNACE FOR METALLURGICAL PURPOSES; P. Girod, Ugine, France. App. filed Dec. 20, 1905. Makes use of a pole piece embedded in the furnace hearth so as to avoid avoid exposing it to too great a temperature.

921,237. ELECTRIC SWITCH FOR RAILWAY TRAFFIC CONTROLLING DEVICES; L. Griffith, Yonkers, N. Y. App. filed June 20, 1904. Has a stationary member and two members movable with reference thereto.

921,265. TROLLEY HEAD AND TROLLEY; G. H. Merwin, Milford, Conn. App. filed Nov. 27, 1908. A self-oiling trolley head, the

trolley having a grooved flange with a web having a central opening, side plates secured to the flange and provided with radial slots.

921,280. TIME-INDICATING SYSTEM; A. A. Radtke, Chicago, Ill. App. filed June 29, 1908. A plurality of clocks are controlled by a master clock. The improvement is in the contact mechanism.

921,293. TRANSMITTING APPARATUS; H. Shoemaker, Jersey City, N. J. App. filed Aug. 30, 1907. For wireless telegraphy in which a closed oscillation circuit contains a plurality of condensers in series with each other and with inductance, together with a direct connection from the charging source to the terminals of less than the whole number of condensers.

921,299. VOLTAGE REGULATOR; S. D. Sprong and W. E. McCoy, New York, N. Y. App. filed Oct. 3, 1908. Means for compensating voltage variations by throwing a variable rheostat in series with the load, which rheostat is controlled by a motor which, in turn, is controlled by a solenoid actuated by the load circuit.

921,308. THERMOSTAT; J. H. Swan, Chicago, Ill. App. filed June 15, 1905. Thermostat for steam heaters which operates the steam valve of a radiator through electrical mechanism.

921,311. ALTERNATING-CURRENT REGULATOR; C. H. Thordarson, Chicago, Ill. App. filed July 27, 1906. For use with X-ray apparatus, including a coil with a core movable relatively into and out of the coil and of variable cross-sectional area.

921,314. TROLLEY HARP; F. A. Tribbe, Ironton, Mo. App. filed Sept. 23, 1908. A trolley harp having a pivoted member carrying one bearing for the shaft of the trolley wheel.

921,318. TELEPHONE SYSTEM; H. G. Webster, Chicago, Ill. App. filed July 5, 1906. A telephone line circuit provided with a double-acting relay which displays a line signal in response to a partial energization and prevents the display when energized to a greater extent.

921,319. SIGNALING SYSTEM; H. G. Webster, Chicago, Ill. App. filed July 5, 1906. For telephone systems in which a double-acting relay with two windings is connected with the transmitting circuit, one in the transmitting circuit and the other in a local circuit. When the circuit is grounded, the local winding of the double-acting relay is thrown in, which interrupts the circuit of the receiver and throws in a signal showing that the individual circuit is in trouble.

921,320. SIGNALING SYSTEM; H. G. Webster, Chicago, Ill. App. filed July 5, 1906. Similar to 921,319.

921,321. TELEPHONE SYSTEM; H. G. Webster, Chicago, Ill. App. filed July 5, 1906. Two-wire system with means for securing a busy test without undue interference with a conversation by associating with the cord circuit, special contacts controlled by the listening key for the test circuit and other contacts control led by a relay for maintaining the talking circuit.

921,325. ELECTRIC SMELTING FURNACE; C. E. Wilson, Hood River, Ore. App. filed July 30, 1908. For the production of ferro-titanium in steel foundries, by means of electrodes which dip into the furnace until the pressure lifts a valve closing the furnace and allows the gas to escape.

921,326. SUBMARINE SIGNALING APPARATUS; E. C. Wood, Somerville, Mass., and F. M. Durkee, Newton; W. F. Kelley and J. B. Millet, Boston, Mass. Makes use of an indicator and telephone with a series of transmitters arranged about the vessel, the telephone being connectable to either one of the transmitters, together with an electrical indicator for indicating the transmitter connections.

921,327. BRUSH-HOLDER FOR ELECTRIC MACHINES; J. H. Woolliscroft, Hawarden, Eng. App. filed Nov. 20, 1908. A brush-holder encircles the brush bar and is provided with a toggle for tightening it on the bar and also has means for applying pressure to the brush.

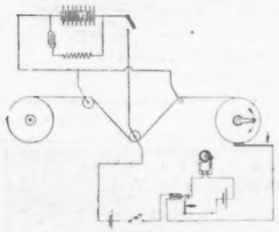
921,334. TELEPHONE TRANSMITTER; H. F. Albright, New York, N. Y. App. filed Feb. 24, 1906. Details in the construction of transmitters employing a cup containing carbon granules.

921,362. WIRE SUPPORT; T. P. Chandler, Philadelphia, Pa. App. filed July 14, 1908. A support for electric wires in which a two-part clamp clamps the wire, the back of the clamp being secured in an insulator.

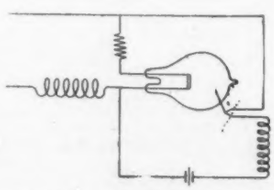
921,384. SELF-RESTORING CLEAR-OUT DROP FOR TELEPHONE SWITCHBOARDS; C. D. Enochs, La Crosse, Wis. App. filed April 30, 1906. When the plug at the end of the cord is raised to make a connection a spring raises a lever which releases the shutter. When the plug returns the weight on the cord pulls back the spring and lever and automatically restores the shutter.

921,385. ANNUNCIATOR; C. D. Enochs, La Crosse, Wis. App. filed July 5, 1907. A drop annunciator for telephone switchboards, provided with a removable coil on the magnet, for operating the drop.

921,391. STORAGE BATTERY PLATE; B. Ford, Philadelphia, Pa. App. filed July 10, 1907. Has a conducting grid having open-faced



920,970. Foiled Paper and Method of Producing Same.



921,526. Apparatus for the Production of Undamped Electrical Vibrations.

receptacles for active material and laminated retaining walls consisting of piles of thin sheets.

921,392. SYSTEM OF DISTRIBUTION; B. Frankenfield, Milwaukee, Wis. App. filed Oct. 14, 1908. Improvement on patent 850,217 employing a booster armature carrying half of the neutral-wire current.

921,398. AUTOMATIC MOTOR STARTER; C. T. Henderson and C. H. Miller, Milwaukee, Wis. App. filed Jan. 7, 1905. Makes use of an air compressor and reservoir in which the air is compressed by a motor controlled from a pressure regulator. The improvement lies in the electric controlling means.

921,408. CLUSTER FIXTURE FOR ELECTRIC LAMPS; P. H. Jaehnig, Newark, N. J. App. filed March 15, 1906. A plural cluster fixture or plural lamp socket having an insulating base with a hollow projection and associated lamp contacts carried by the base with connecting plates on opposite sides of the projection.

921,429. MEANS FOR COUNTING CONVERSATIONS AT TELEPHONE EXCHANGES; J. H. Meyer, Madgeburg, Germany. App. filed July 12, 1907. A counter provided with a circuit closer connected with the speaking and the call change over switch, a relay and incandescent lamp, the counting being effected at the end of the call and after the subscriber has taken up the receiver.

921,430. SELF-STARTER FOR ELECTRIC MOTORS; C. H. Miller, Milwaukee, Wis. App. filed Oct. 24, 1904. A rheostat for a motor is operated by means of a solenoid, the circuit through which is closed when the pressure in an air compression tank falls and opened when the pressure rises.

921,434. KNIFE SWITCH; J. H. Miller, Bridgeport, Conn. App. filed Oct. 14, 1907. Improvement in the joint between the block and the blades of the switch.

921,447. APPARATUS FOR AUTOMATICALLY THROWING OUT THE RESISTANCE IN CHARGING STORAGE BATTERIES; G. Pattberg, New York, N. Y. App. filed Oct. 6, 1908. A single solenoid closes the motor circuit before the change in the battery

921,108. Magnetic Electric Light Holder.

resistance and interrupts the circuit after the change is completed. A circuit breaker and controller cut off the source of supply when the battery is charged.

921,454. APPARATUS FOR THE ELECTRIC LIGHTING OF RAILWAY CARRIAGE; E. M. Preston, Deptford and A. E. Kennard, Anerley, Eng. App. filed Sept. 29, 1908. Improvement in car lighting systems in which a dynamo supplies current to the lamps at speed and charges batteries below speed, by means of a switch operated by a governor. Improvement in the sliding framework operated by the governor.

921,474. TROLLEY; C. W. Smith, Haverhill, Mass. App. filed April 9, 1908. A sheave for each journal of the trolley wheel, detachably secured to the trolley head and each having an oil chamber.

921,487. COUPLING FOR SECTIONAL RODS; R. H. Villard, Rochester, N. Y. App. filed Sept. 18, 1906. Interlocking heads for coupling sectional rods used in underground conduits.

921,505. ROTOR CONSTRUCTION; B. A. Behrend, Norwood, Ohio. App. filed June 25, 1906. A cylindrical core body having radial slots for field coils and solid pole pieces, the ends of the pole being slotted for the passage of air.

921,508. THIRD-RAIL SYSTEM; Y. Burgess, Washington, D. C. App. filed Jan. 29, 1908. A stand for third rails having a stem with conductor supports projecting from opposite sides of the stem and a roof on the stem above the supports.

921,512. TROLLEY; P. Coval and D. A. Kunkle, New Kensington, Pa. App. filed Nov. 3, 1908. A pentagraph trolley having pivoted arms for maintaining the trolley wheels on the wire.

921,520. CHANDELIER; O. Dodge and S. G. Camp, Colorado Springs, Col. App. filed Feb. 10, 1908. A combination gas and electric fixture having two concentric spaced tubes to provide a gas passage between them with a longitudinally adjustable member inside of the tubes for carrying the electric light wires.

921,526. APPARATUS FOR THE PRODUCTION OF UNDAMPED ELECTRICAL VIBRATIONS; S. Eisenstein, Kief, Russia. App. filed March 27, 1908. A Wehnelt cathode ray tube, an anode in the tube and a cathode within the same coated with oxids of rare earths.

921,531. RECEIVER FOR ELECTROMAGNETIC WAVES; R. A. Fessenden, Washington, D. C. App. filed April 25, 1906. Utilizes the variation in pressure between an electro light and an electrode in contact therewith by the flow of electric oscillations therethrough, the resulting motion giving a signal.

921,584. OUTLET BOX FOR ELECTRIC CONDUITS; W. A. Bonnell, New York, N. Y. App. filed Aug. 1, 1908. An outlet box having one or more stationary conduit receiving bushes fixed to the base and conduit clamping plates located at the rear of the base and engaging the conduits in the plane of the base.

921,585. COMBINED CONDUIT CLAMP AND KNOCK-OUT DISK; W. A. Bonnell, New York, N. Y. App. filed Nov. 21, 1908. A knock-out disk and clamping plate in one piece so that when the knock-out disk is broken out the roughened edge of the clamping disk grips the conduit.

921,589. CONTROLLER FOR ELECTRIC MOTORS; H. W. Cheney, Milwaukee, Wis. App. filed Oct. 5, 1908. Means for biasing the movable member of the controller forward to off position during one part of the movement and backward to off position during another part of the movement and unbiased in running position.

921,601. INTERRUPTER CIRCUIT AND APPARATUS; J. F. Engle, Cleveland, Ohio. App. filed June 12, 1907. For producing currents for signaling purposes by means of a vibratory contact member and an electromagnetic apparatus having high and low resistance windings.

921,625. DOUBLE CIRCUIT FLASHER; W. J. Phelps, Detroit, Mich. App. filed Sept. 7, 1906. For controlling the circuits of two sets of advertising lamps. Does away with the motor and makes use of a thermostat with a resistance heater controlling it so that the current flowing through the resistance changes the resistance and operates the thermostat to shift the circuit.

921,630. SYSTEM OF ELECTRICAL DISTRIBUTION; B. R. Shover, Chicago, Ill. App. filed Dec. 24, 1906. Improvement in three-phase distribution system supplied through a transformer from a direct current circuit or through an alternating current supply source.

921,641. METHOD OF PREVENTING CORROSION OF METALS IMMERSED IN LIQUIDS; P. E. G. Cumberland, St. Kilda, Victoria, Australia. App. filed June 13, 1907. Prevents corrosion of screw propeller blades, etc., when in contact with sea water by providing two different metals in juxtaposition and constituting the negative electrode and placing an iron electrode in contact with the water in proximity to the screw propeller.

921,642. CONTROLLER FOR ELECTRICAL APPARATUS; F. Darlington, Great Barrington, Mass. App. filed Oct. 20, 1908. A controller having conducting segments with a switch arm engaging them, a reversing switch and ratchet for operating it.

921,650. TROLLEY HEAD; J. E. Robbins, Greensburg, and W. A. and C. P. Kirkpatrick, Indianapolis, Ind. App. filed Feb. 8, 1908. A trolley head having a pair of pivoted spring pressed arms arranged to replace the trolley wheel on the wire. The arms embrace the wire when the wheel leaves it.